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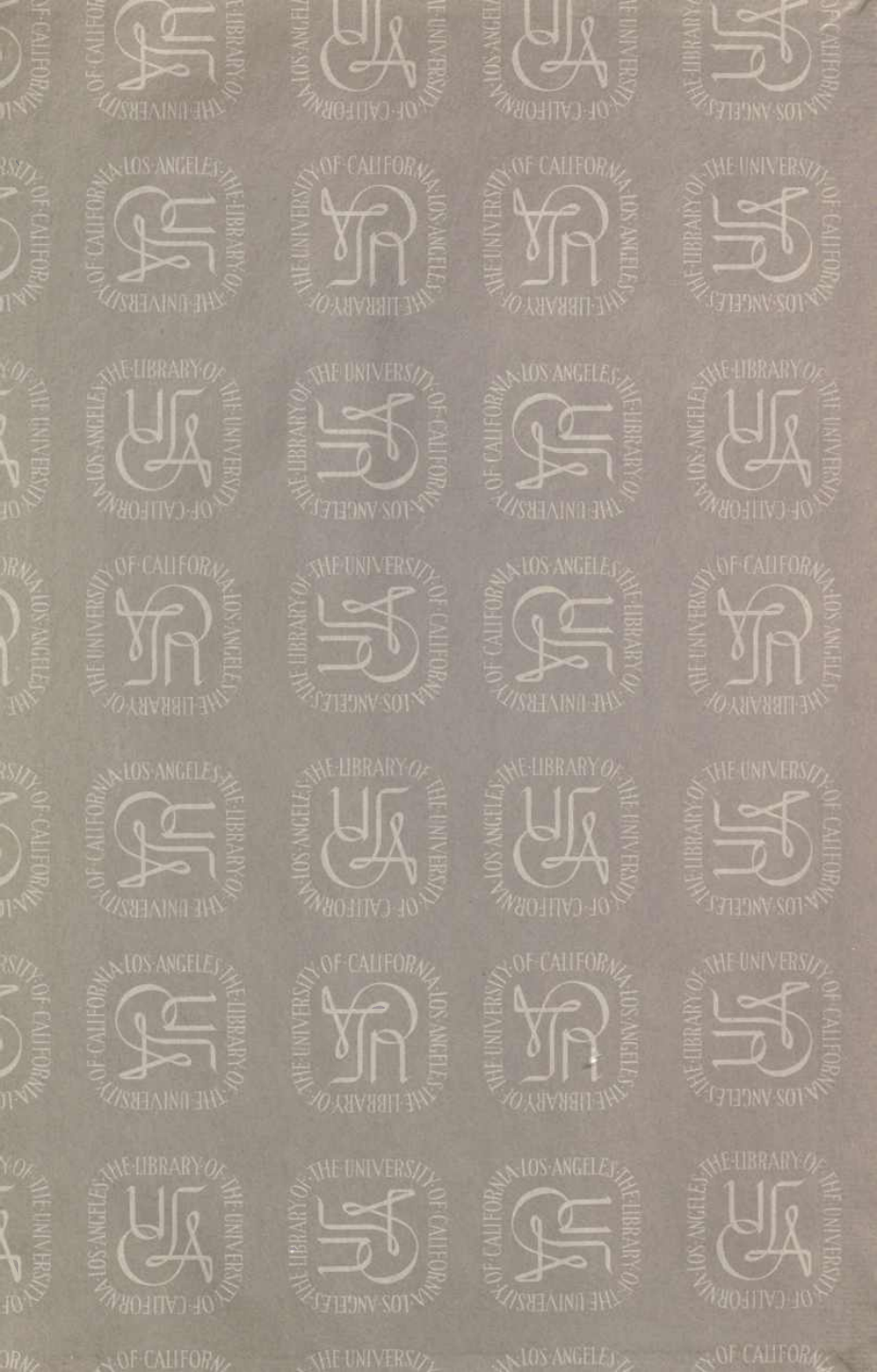
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A PRELIMINARY LIST OF THE UREDINALES OF CALIFORNIA

BY

WALTER C. BLASDALE

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I. INTRODUCTORY STATEMENT

The study of the *Uredinales* of California began with the pioneer work of Dr. H. W. Harkness and Justian P. Moore, who in 1880 published a *Catalogue of Pacific Coast Fungi*, which enumerates fifty-five species belonging to this group. Unfortunately this list does not give the specific names of a large number of the host plants referred to and also the localities are often very indefinite, which makes it difficult to correlate this list with the work of subsequent collectors. Somewhat later Dr. Harkness, either in conjunction with M. C. Cooke and J. B. Ellis, or independently, published in *Grevillea* and in the *Bulletin of the California Academy of Sciences* a number of new species including many Uredinales. The extensive collections of Pacific Coast fungi which Dr. Harkness had presented to the California Academy of Sciences before his death were destroyed in the great fire of 1906, with the exception of the types of new species discovered by him, which fortunately were preserved through the foresight of Miss Alice Eastwood, the present Curator of the Herbarium.

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In 1882 Mr. E. W. D. Holway began work on the rust flora of California by an extended exploration of King's River Cañon and vicinity, which brought to light a large number of species, some of which were published as new by Dietel and Holway, especially in *Erythea* and *Hedwigia*. With the aid of Mr. Holway this work was continued by the writer, and collections were made in the region about San Francisco Bay (1893 and later), Shasta and Siskyou counties (1894), Tuolumne and Calaveras counties (1895), Lake Tahoe (1897), and Mendocino and Humboldt counties (1896 and 1899). Contemporaneously and in the succeeding years a large number of collectors did work in other regions. Of these especial mention should be made of A. J. McClatchie (Pasadena), S. B. Parish (San Bernardino), J. Burtt Davy (Berkeley), W. R. Dudley, and C. H. Thompson (Stanford University). In more recent years extensive collections have been made by Ellsworth Bethel, Carl T. Baker, David Griffiths, E. E. Heller, Dr. Meinicke of the Federal Forest Service, and Professor Horne of the Agricultural Experiment Station of the University of California.

II. THE NEED OF EXPERIMENTAL CULTURE WORK

Although much more extended collections and critical studies in both field and laboratory must be made before our knowledge of the California representatives of this group of fungi can be considered either exact or complete, it is believed that an attempt to summarize the information now available will be of assistance to those working on the rust flora of the state and will give at least an approximate idea of its extent and content. The need of systematic culture experiments designed to establish with certainty the life histories of those species which are known to be heteroecious is a pressing one. The results obtained in other regions of the United States, especially by Arthur and his collaborators at Purdue University, suggest the species of host plants probably concerned in the life histories of many of the Pacific Coast species; but the differences in the climatic conditions of the two regions and of the species of host plants found in them make it extremely desirable to confirm these suggestions by actual experiments. It is to be regretted that owing largely to the lack of such data it has been found necessary to include in the list here presented a considerable number of form species, that is, aecial and uredineal forms not definitely correlated with the mature forms

necessary for their identification. Apparently an unusually large number of Pacific Coast forms winter over, by means of uredineal spores, and produce telia only occasionally and in very small amounts or fail entirely to do so.

Culture experiments are also greatly needed for the purpose of ascertaining the specific identity of many of those species which develop on closely related host plants, such, for instance, as the forms of *Puccinia* which are found on the different genera of the *Onagraceae* and *Compositae*. Such experiments in other regions have shown great variability as to the closeness of the adaptation between the rust and its host. In some instances, as illustrated by the classical work of Eriksson and Hennings with the grain rusts, this relation is an extremely narrow one and it becomes clearly necessary to recognize species or subspecies based upon purely physiological distinctions. It has been shown by Bethel, on the other hand, that certain species, such as *Puccinia subnitens* and *P. stipae,* produce their aecia on hosts belonging to genera representing widely different natural families, and it is not improbable that too much emphasis has been placed upon the host plant as a criterion in ascertaining the specific limitations of the rusts.

III. PLAN OF THE PRESENT PAPER

As one of the chief objects of the present publication is to assist collectors in naming new collections and to tabulate all the known forms and their accompanying host plants, the different genera, which can usually be readily recognized if the mature form is at hand, have been arranged alphabetically, and where a large number of species are represented those species which occur on host plants belonging to the same natural family have been grouped together and the groups arranged according to the sequence of families found in Jepson's *Flora of Middle Western California.*

The references cited are designed merely to identify with certainty the form referred to and to indicate where a description of it can be found. Only those synonyms have been given which are necessary to show where certain species, whose validity is not accepted, belong in the list.

The data represented by the list is based almost wholly upon specimens in the herbarium of the writer, and the name of the collector of each specimen cited is given in parenthesis except where the collection is that of the writer, in which case it is omitted.

IV. ACKNOWLEDGMENTS

The completeness of the survey of the rust flora of California here presented is in a large measure due to the assistance of the collectors whose names have been cited, who have furnished specimens or have given additional data regarding them. Especial obligations are due Mr. Ellsworth Bethel for a large amount of information regarding the heteroecious species, and for extended collections of grass and sedge inhabiting species from the southern part of the state both of which are poorly represented in most of the collections which have been made up to the present time. I desire also to express my thanks to Professor J. C. Arthur, who read over the entire list of species here presented and made many valuable suggestions. It will also be obvious that much help has been derived from such portions of Arthur's arrangement of the North American species of Uredinales (*North American Flora,* vol. 7) as have been published, of the critical work of Holway in that portion of his *North American Uredineae* which has been published, and Jackson's *Uredinales of Oregon,* published in the *Memoirs of the Brooklyn Botanic Garden.*

V. GENERAL FEATURES OF THE UREDINALES

The Uredinales represent a group of fungi whose vegetative parts consist of a much branched and septate mycelium, which develops in the leaves, branches, and fruits of certain seed producing plants and ferns and abstracts nourishment from the cells of the surrounding tissues by means of haustoria. The reproductive parts are represented by five different types of spores, one or more of which are frequently lacking and which differ greatly as to form and size as well in the mode of production and germination. The different spore forms are the following:

Spermatia, designated by the symbol O, are produced in subglobose or flask-shaped spermogonia and are minute hyaline bodies, which can be made to germinate but do not appear to perform any important function in the life history. They usually appear with or slightly before the aecia.

Aeciospores, designated by the symbol I, are produced in cup-shaped or cylindrical aecia, which have a more or less well developed peridium, or in masses, frequently surrounded by paraphyses, in which a peridium is lacking. They are always one-celled and are formed by the successive abstriction of the ends of closely packed

hyphae. They have a hyaline epispore and a number of germ pores but rapidly lose their ability to germinate.

Urediniospores designated by the symbol II, are usually produced in subepidermal sori and ultimately burst through the epidermis as light brown or yellow pulverulent masses. They are produced singly at the ends of hyphae, are always one-celled, either globose, elliptical or pyriform, possess several germ pores and are either echinulate or tuberculate.

Teliospores, designated by the symbol III, are formed like the urediniospores, but sometimes appear singly, either in or on the tissues of the host. They usually possess a definite pedicel and may be fascicled or compacted into a crust or a cylindrical column. Each spore may consist of a single cell or of as many as twenty cells; each cell usually possesses a single germ pore. They possess a thick epispore, which is dark brown or black in color. On germination they produce a thick promycelial tube, which ultimately produces four cells, each of which develops a single basidia and sporidium. When the sporidia germinate they produce short tubes which are able to penetrate the tissues of the proper host plant. The formation of basidia is one of the most distinguishing characteristics of the group.

Many species show well characterized alternation of generations on host plants belonging to the same species (autoecious) or on host plants belonging to different species (heteroecious).

VI. LIST OF SPECIES

The genera are arranged alphabetically, and the species numbered consecutively throughout the paper.

AECIDIUM

Under this form genus are grouped those aecial forms which have a true peridium and for which no other stage has as yet been recognized.

1. **Aecidium Collinsiae** Ell. and Ev.
   Bull. Washb. Lab., vol. 1, p. 4, 1884.

On *Collinsia bicolor* Benth., Berkeley and Ukiah.

2. **Aecidium Graebnerianum** Hennings
   Hedwigia, vol. 37, p. 273, 1898.

On *Habenaria dilatata* (Pursh.) Hook., Death Valley (Coville); on *H. leucostachys* Wats., Mount Eddy (Copeland).

3. **Aecidium Triglochinis** Diet. and Holw.
Erythea, vol. 7, p. 98, 1899.

On *Triglochin concinna* Davy, Lassen County, type collection (Davy).

4. **Aecidium Valerianellae** (Biv.) Bernh.
Stirp. Rar. Sci., vol. 4, p. 28.

On *Valerianella congesta* Lindr., Mill Valley and Applegate.

BAEODROMUS ARTH.

Ann. Mycologici, vol. 3, p. 19, 1905.

Cycle of development includes pycnia and telia only. Telia subepidermal but erumpent; teliospores one-celled, ellipsoid, produced in chains but compacted into masses.

5. **Baeodromus californicus** Arthur. III
Ann. Mycologici, vol. 3, p. 19, 1905.

On *Senecio Douglasii* DC., Lytle Creek, San Bernardino Mountains (Parish).

BUBAKIA ARTH.

Résult. Sci. Cong. Bot. Vienne, p. 338, 1906.

Uredinia erumpent and pulverulent; urediniospores borne singly on pedicels. Telia subepidermal and indehiscent; teliospores one-celled, compacted into dense masses.

6. **Bubakia Crotonis** (Cke.) De Toni. II, III
Grevillea, vol. 6, p. 137, 1878.

On *Croton californicus* Müll. Arg., San Francisco, Long Beach (Bethel).

CALYPTOSPORA KÜHN

Hedwigia, vol. 8, p. 81, 1869.

Aecia erumpent, cylindrical with thin-walled peridium. Telia forming compact layers, indehiscent. Teliospores ellipsoid, usually four-celled.

7. **Calyptospora columnaris** (Alb. and Schw.) Kühn. 0, I, III

The aecial stage has been shown by Winter (Hedwigia, vol. 26, p. 28, 1887) to develop on a large number of species of *Abies*, including *A. magnifica* Murray and *A. concolor* Lindl. Arthur (Mycologia,

vol. 2, p. 231, 1910) also obtained aecia on potted plants of *A. Fraseri* (Pursh.) Lindl., which he had infected with *C. columnaris* from Nova Scotia, and Professor Frazier found aecia identical with those obtained by Arthur on *Abies balsamea* at Picto, Nova Scotia. In California Meinicke has collected similar aecia on *Abies concolor* Lindl. at Lake Tahoe, and on *A. magnifica* Murray at Heckel's, Lassen County.

Telia on *Vaccinium ovatum* Pursh. and *V. parvifolium* Smith, Santa Cruz, Marin, Mendocino and Humboldt counties; on *V. membranaceum* Pursh., Tahoe National Forest (Meinicke); on *V. Chandleri* Jepson. Mount Eddy (Copeland).

COLEOSPORIUM LEV.

Ann. sci. nat. I, Bot., vol. 8, p. 373, 1847.

Aecia definite, erumpent; peridium colorless. Uredinia erumpent, pulverulent, spores in chains. Telia waxy, indefinite, liberated by disintegration of host only. Heteroecious.

8. **Coleosporium Bletiae** Diet. II, III

Hedwigia, vol. 37, p. 218, 1898.

On *Phajus Wallichii* Lindl. Reported by Arthur (*N. A. Flora*, vol. 7, p. 86) on plants imported from Japan, but not found by the writer although frequent inquiries were made for it.

9. **Coleosporium Campanulae** (Pers.) Lév. 0, I, II, III

Syn. Fung., p. 217, 1801; Ann. Sci. Nat., sér. 3, Bot., vol. 8, p. 373, 1847.

The aecial stage not known from California, but found on the Atlantic Coast on *Pinus rigida* and *P. virginiana*.

Uredinia and telia on *Campanula persicifolia* Linn., San Francisco. Probably a recent introduction as it was first noted by the writer in 1915 on the Exposition grounds.

10. **Coleosporium Madiae,** Cooke. II, III

Grevillea, vol. 7, p. 102, 1879; Sydow, Ann. Mycologici, vol. 2, p. 30, 1904.

Aecial stage probably represented by *Peridermium californicum* Arth. and Kern (see no. 35).

Uredinia and telia on *Madia capitata* Nutt., *M. anomala* Greene, *M. dissitiflora* (Nutt.) T. and G., *M. elegans* Don., *M. sativa* Molina, *M. Nuttallii* Gray, *Centromadia pungens* (H. and A.) Greene, and *Zonanthis corymbosa* (DC) Greene. Very common throughout the central portion of the state.

11. **Coleosporium Solidaginis** (Schw.) Thüm. 0, I, II, III

Bull. Torr. Club, vol. 6, p. 216, 1878.

The aecial stage probably represented by *Peridermium montanum* Arth. and Kern, which is reported from California by Hedgecock (Phytopathology, vol. 6, p. 64, 1916).

Uredinia common in the bay region on *Aster radulinus* Gray, *A. Menziesii* Lindl., *A. chilensis* Nee., and *Solidago californica* Nutt. On *Aster* sp., Yosemite Valley (Bethel); on *Solidago confinis* Gray, Pasadena (McClatchie).

CRONARTIUM FRIES

Observ. Myc., vol. 1, p. 220, 1815.

Aecia erumpent, inflated, usually forming galls. Uredinial spores born singly on pedicels. Telia erumpent, scattered; teliospores formed in chains which adhere to form a cylindrical column, one-celled, usually fusiform. Heteroecious.

12. **Cronartium coleosporioides** (Diet. and Holw.) Arthur. 0, I, II, III

Erythea, vol. 1, p. 247; N. A. Flora, vol. 7, p. 123, 1907.

The aecial stage (*Peridermium Harknessii* Moore) produces spheroid galls on *Pinus contorta* Dougl., *P. Sabiniana* Dougl. and *P. ponderosa* Dougl. Widely distributed throughout the Sierras, also at Mount Diablo (Blasdale and Bethel).

Uredinia and telia on *Castilleja foliolosa* H. and A., Berkeley (type of *Uredo coleosporiodes* Diet. and Holw.), also Mill Valley (Bethel); on *C. latifolia* H. and A., and *C. Wightii* Elmer, Moss Beach (Mrs. Brandegee); on *C. miniata* Dougl., Lassen National Forest (Meinicke); on *C.* sp., Lake Tahoe (Bethel); on *C. Douglasii* Benth., San Mateo County (Copeland), on *C. Martini* Abrams, San Diego (Bethel).

13. **Cronartium filamentosum** (Peck) Hedgcock. 0, I, II, III

Bot. Gaz., vol. 7, p. 56, 1882; Phytopathology, vol. 2, p. 176, 1912.

The aecial stage produces slight hyperthrophy of branches on *Pinus ponderosa* Dougl. (*Peridermium filamentosum* Peck), Lake Tahoe; on *P. contorta* Dougl., Lake Tahoe, Plumas County (Meinicke).

Telia on *Castilleja miniata* Dougl., and according to Hedgcock not distinguishable morphologically from those of *Cronartium coleosporioides*, Lake Tahoe.

14. **Cronartium pyriforme** (Peck) Hedg. and Long. 0, I, II, III
Bull. Torr. Club, vol. 6, p. 13, 1875, and vol. 11, p. 50, 1884.

Aecia on *Pinus ponderosa* Dougl. (*Peridermium pyriforme* Peck) Rocky Gulch, Siskiyou County (Meinicke).

Uredinia and telia on *Comandra umbellata* (L) Nutt. (*Cronartium Comandrae* Peck), Shasta Springs. The genetic connection between these forms was shown by Hedgcock and Long (Bull. 247, U. S. Dept. Agr., 1914), also by Kirkwood (Phytopathology, vol. 5, p. 233, 1915).

15. **Cronartium Quercus** (Brond.) Schröt. 0, I, II, III
Sacc. Michelia, vol. 2, p. 308, 1881.

The aecial stage (*Peridermium Harknessii* Moore) produces globose galls often of large size on branches of *Pinus radiata* Don, and is sometimes very destructive. Also on *P. attenuata* Lemmon, *P. muricata* Don and *P. ponderosa* Dougl. in the central Coast Ranges.

Uredinia and more rarely telia on *Quercus agrifolia* Nee., *Q. Kellogii* Newb. and *Pasania densiflora* Oerst., Gilroy, Mount Diablo, Monterey (Meinicke), Mill Valley (Bethel), Santa Barbara (Bethel); on *Q. dumosa* Nutt., Pasadena (McClatchie).

There seems to be no essential difference between the eastern and western forms of this species, although culture experiments are needed to prove this conclusively. Meinicke (Phytopathology, vol. 6, p. 225, 1916) has shown that aecial spores from *Pinus radiata* could be made to reproduce aecia on the same host without an intervening stage; also that the fungus winters over in the uredinial stage on the leaves of *Quercus agrifolia*.

ERIOSPORANGIUM (BERTERO) LEV.
Ann. Sci. Nat., sér. 3, vol. 5, p. 269, 1846.

Aecia usually indefinite, peridium usually fragile. Uredinia definite, without paraphyses. Teliospores two-celled, usually pale or colorless.

16. **Eriosporangium evadens** (Hark.) Arthur. 0, I, II, III
Bull. Calif. Acad. Sci., no. 1, p. 34, 1884; Arthur, Résult. Sci. Cong. Bot. Vienne, p. 343, 1906.

The aecial stage is probably *Coleosporium Baccharidis* Cooke (Grevillea, vol. 9, p. 7, 1880), which produces galls often of large size on the branches of *Baccharis consanguinea* Greene and *B. pilularis* DC, similar to those of the bark-inhabiting species of *Peridermium*.

Uredinia and telia occur on the leaves of the same hosts, but as the sori are small they are easily overlooked. The genetic connection between the two forms has not been proven; but the frequency with which they are associated makes it probable that they are so related. It is common throughout the bay region and in southern California.

17. **Eriosporangium punctato-striatum** (Dietel and Neger) Arthur

Bot. Jahrb., vol. 22, p. 357, 1896; N. A. Flora, vol. 7, p. 213, 1912.

Aecia on stems and leaves on *Baccharis viminea* DC, but does not produce conspicuous galls.

Uredinia and telia on the same host (type of *Puccinia Baccharidis* Diet. and Holway), Santa Rosa, Los Gatos, Pasadena (McClatchie), San Bernardino (Parish), Paso Robles (Bethel), San Ysidro (Bartholomew), Lakeside (Bethel).

GYMNOSPORANGIUM HEDW.

Flora française, vol. 2, p. 216, 1805.

Aecia usually cylindrical but rarely cupulate; peridia membranous, the cells imbricate. Uredinia with one exception lacking. Telia naked, gelatinous, and somewhat elastic when mature; teliospores two-celled, sometimes three- to five-celled, by transverse septa, pedicels hyaline, usually long.

18. **Gymnosporangium Blasdaleanum** (Diet. and Holw.) Kern I, III

Erythea, vol. 3, p. 77, 1895; Kern, Bull. N. Y. Bot. Gard., vol. 7, p. 437, 1911.

Aecia on *Amelanchier alnifolia* Nutt. and *Crategus rivularis* Nutt., Sisson and Shasta Springs, type collection; on *Amelanchier alnifolia* Nutt., Hoopa Valley, Plumas County (Meinicke), Yosemite Valley and Lake Tahoe (Bethel), on *Amelanchier pallida* Greene and *Crategus Douglasii* Lindl., northern California (Kern.). This has the well developed peridium of a typical aecidium.

Telia on *Libocedrus decurrens* Torr. Sisson, Hoopa Valley, Siskiyou County (Copeland), Potter Valley (Purpus), Yosemite Valley and Lake Tahoe (Bethel); "widely distributed throughout the northern part of the state" (Meinicke). It sometimes produces witches' brooms of some size, but the spore masses, which appear as brown cushions on the smaller twigs and leaves, are not conspicuous.

The genetic connection between the two stages was first established by Arthur (Mycologia, vol. 1, p. 252, 1909, vol. 4, p. 57, 1912), who succeeded in growing aecia on *Crategus Pringlii* Sarg. from telia obtained from Corvallis, Oregon. From the latter state it is reported to be a rather serious pest by O'Gara (Science, vol. 39, p. 60, 1914), and by Jackson (Phytopathology, vol. 4, pp. 41, 261), attacking especially pears, quinces, and certain varieties of apples.

19. **Gymnosporangium Harknessianum** (Ell. and Ev.) Kern. I, III

Bull. N. Y. Bot. Gard., vol. 7, p. 441, 1911.

Aecia on *Amelanchier alnifolia* Nutt., Klamath River (Harkness), Plumas County (Meinicke).

What is believed to be the telial stage of this species has been collected by Meinicke on *Juniperus occidentalis* Hook., near Clio, Plumas County.

20. **Gymnosporangium koreaense** (P. Hennings) Jackson. I, III

Jour. Agr. Res., vol. 5, p. 1006, 1916.

Aecia on leaves of an ornamental species of *Pyrus* from a nursery near Oakland (D. P. T. MacDonald), but not otherwise reported from the state.

Telia not reported from California, but found in Oregon on *Juniperus chinensis Lindl.* (Jackson).

HYALOPSORA MAGN.

Ber. deut. bot. Ges., vol. 19, p. 582, 1901.

Aecia without peridium not conspicuous, irregularly dehiscent; aeciospores borne singly on pedicels, colorless. Uredinia with globoid peridium. Telia scattered, indehiscent; teliospores globoid, usually four-celled, colorless, wall thin and smooth.

21. **Hyalopsora Cheilanthis** (Peck) Arthur. II

Bull. Torr. Club, vol. 10, p. 62, 1883; Arthur, N. A. Flora, vol. 7, p. 113, 1907.

On *Pellaea andromedafolia* Kaulf., San Gabriel Cañon (Leroy Abrams); on *Ceratopteris triangularis* (Kaulf.) Underwood, Pasadena, type of *Uredo pasadenae* Sydow (McClatchie), Mount Tamalpais; Julian, San Diego County (Bethel).

22. **Hyalopsora laeviscula** (Diet. and Holw.) Arthur. II, III

Erythea, vol. 2, p. 127, 1894; Arthur, N. A. Flora, vol. 7, p. 113, 1907.

On *Polypodium californicum* Kaulf., Mount Tamalpais, type collections.

23. **Hyalopsora Polypodii** (DC) Magnus. I, II, III

Fl. franc., vol. 6, p. 81, 1815; Magnus, Ber. deut. bot. Ges., vol. 19, p. 582, 1901.

On *Filix fragilis* (L) Underwood, Humboldt County, King's River Cañon (Holway).

KUEHNEOLA MAGN.

Bot. Centralbl., vol. 74, p. 169, 1898.

Uredinia definite, erumpent, usually with paraphyses; urediniospores borne singly on pedicels, usually pale or colorless; telia erumpent, without paraphyses; teliospores three- to seven-celled, with transverse septa.

24. **Kuehneola uredinis** (Link) Arthur. 0, II, III

Willd. Sp. Plant, vol. 6, p. 123, 1824; Arthur, N. A. Flora, vol. 7, p. 186, 1912.

On *Rubus vitifolius* Cham. and Schlecht., reported by Arthur from California but not seen by the writer.

KUNKELIA ARTHUR

Bot. Gaz., vol. 63, p. 504, 1917.

This genus is based upon the fact, first shown by Kunkel (Bull. Torr. Bot. Club, vol. 40, p. 361, 1913, Am. Jour. Bot., vol. 1, p. 37, 1914), that the entire life cycle consists of a caeomoid stage associated with pycnia, the spores of which germinate like teliospores. It is not distinguishable morphologically from the aecial stage of the genus *Gymnoconia,* but the aecial spores of the genus last named germinate like true aecia spores, and there is an alternate stage not distinguishable from the telia of the genus *Puccinia.*

25. **Kunkelia nitens** (Schwein) Arthur. 0, I

Bot. Gaz., vol. 63, p. 504, 1917.

On *Rubus vitifolius* Cham. and Schl., Santa Rosa, on cultivated blackberry, Orange, Berkeley, Chico (Copeland), Glendora (Baker), Long Beach (Bethel). This is the widely distributed "orange rust" of the blackberry formerly known as *Caeoma nitens.*

26. **Kunkelia Rosae-gymnocarpae** (Dietel) Arthur

Hedwigia, vol. 44, p. 334, 1905; Arthur, Bot. Gaz., vol. 42, p. 505, 1917.

On *Rosa gymnocarpa* Nutt., Amador County, type collection (Hansen), Plumas County (Meinicke), Paso Robles and Yosemite Valley (Bethel). Very little is known about the life history of this rust, but its similarity to the preceding species makes it probable that it is also a short-cycle form. It appears very early in the spring and produces hypertrophy and ultimate death of the affected shoots.

MELAMPSORA CAST.

Observ., vol. 2, p. 18, 1843.

Aecia erumpent, peridia and pycnia wanting. Aeciospores globose with colorless walls. Uredinia erumpent, pulverulent, borne singly on pedicels. Telia in waxy layers, indehiscent; teliospores one-celled, prismatic or ellipsoid.

27. **Melampsora albertensis** Arthur. 0, I, II, III

Bull. Torr. Club, vol. 33, p. 517, 1906.

Aecia not reported from California but found in British Columbia and Colorado on *Pseudotsuga mucronata* (Raf.) Sudw. (*Caeoma occidentalis* Arthur).

Uredinia and telia on *Populus tremuloides* Michx., Dunsmuir (E. L. Smith); on *P. trichocarpa* T. and G., Yosemite Valley (Bethel). The genetic connection between these forms was established by Arthur (Mycologia, vol. 4, pp. 29, 58, 1912).

28. **Melampsora Bigelowii** Thüm. 0, I, II, III

Mitth. Forsty. Vers. Oest., vol. 2, p. 37, 1879.

The aecial stage (*Caeoma Bigelowii* Thum. Arth.) not reported from California but found elsewhere on *Larix Lyalii* Parl.

Uredinia and telia on *Salix lasiandra* Benth. and *S. lasiolepis* Benth., Berkeley; on *S. laevigata* Bebb and *S. exigua* Nutt., Long Beach (Bethel). Extremely common and widely distributed.

29. **Melampsora Lini** (Pers.) Desmaz. 0, I, II, III

Syn. Fungi, p. 216, 1901; Desmaz, Pl. Crypt., fasc. 41, no. 2049, 1850.

On *Linum micranthum* Gray, Sisson; on *L. digynum* Gray, Amador County (Hansen). Also reported by Arthur (N. A. Flora, vol. 7, p. 102); on *L. congestum* Gray, *L. Lewisii* Pursh.; *L. Breweri* Gray, and *L. drymarioides* Curran. This species was shown to be autoecious by Arthur (Jour. of Mycol., vol. 13, p. 207, 1907).

30. **Melampsora occidentalis** Jackson. II, III

Phytopathology, vol. 7, p. 354, 1917.

On *Populus trichocarpa* T. and G., Siskiyou, Trinity, and Shasta counties (Meinicke); on *P. Fremontii* Wats., San Bernardino (Parish). These specimens were formerly referred to *Melampsora Medusae* Thüm., from which the species named above differs in a number of minor characters. Still another specimen collected by Bethel on *Populus alba* L. at San José, which has also been referred to *M. Medusae*, has not been satisfactorily named.

MELAMPSOROPSIS (SCHROET) ARTHUR

Résult. Sci. Cong. Bot. Vienne, p. 338, 1908.

Aecia erumpent but laterally flattened; peridium firm. Aeciospores ellipsoid to globoid, walls colorless. Uredinia erumpent, pulverulent. Telia waxy; teliospores in chains, one-celled, oblong or cuboid, walls colorless.

31. **Melampsoropsis Piperiana** Arthur. II

N. A. Flora, vol. 7, p. 120, 1907.

On *Rhododendron californicum* Hook, Humboldt County.

32. **Melampsoropsis Pyrolae** (DC) Arthur. 0, I, II, III

Fl. franc., vol. 6, p. 99, 1815; Arthur, Résult. Sci. Cong. Bot. Vienne, p. 338, 1906.

The aecial stage not reported from California but collected by Hedgcock on *Picea Engelmanii* Parry. The genetic connection of this species with *Peridermium conorum Piceae* was shown by Fraser (Mycologia, vol. 4, p. 183, 1912).

On *Pyrola uliginosa* Torr., Sisson (Holway).

NEORAVENELIA LONG

Bot. Gaz., vol. 35, p. 131, 1903.

Aecia erumpent, without peridium; aeciospores in chains, wall colored. Uredinia erumpent; urediniospores borne singly on pedicels, wall colored. Telia erumpent; teliospores like those of *Ravenelia*.

33. **Neoravenelia Holwayi** (Dietel) Long. 0, I, II, III

Hedwigia, vol. 33, p. 61, 1894; Bot. Gaz., vol. 35, p. 131, 1903.

On *Prosopis juliflora* (Sw.) DC, San Bernardino County (McClatchie).

NYSSOPSORA ARTH.

Résult. Sci. Cong. Bot. Vienne, p. 342, 1906.

Telia erumpent; teliospores three-celled by oblique partitions, laterally flattened; walls deeply colored, spinous.

34. **Nyssopsora echinata** (Lev.) Arth. III

Ann. Sci. Nat., sér. 3, Bot., vol. 9, p. 247, 1848; Arthur, *op. cit.*

On *Oenanthe californica* Wats., San Francisco, Santa Cruz (Thomson); on *Selinum pacificum* Wats., Santa Rosa and Hoopa Valley.

PERIDERMIUM

Under this form genus are grouped those aecial forms for which no other stages are known and which resemble the aecia of *Coleosporium* and *Cronartium*.

35. **Peridermium californicum** Arth. and Kern

Mucologia, vol. 6, p. 118, 1914.

On *Pinus radiata* Don., Monterey (Bethel). This is believed to be the aecial stage of *Coleosporium Madiae* by Meinicke, but the data upon which this conclusion is based has not yet been published.

36. **Peridermium Ephedrae** Cooke

Indian Forester, vol. 3, p. 95, 1877; Arthur and Kern, Bull. Torr. Club, vol. 33, p. 420, 1906.

On *Ephedra californica* Wats., San Diego (Bethel), Riverside County (Parish). Conspicuous on account of its large, orange colored spore masses; see Standley (Plant World, vol. 13, p. 61, 1909).

PHRAGMIDIUM LINK.

Ges. nat. Freunde, Berlin, vol. 7, p. 30, 1915.

Aecia erumpent, usually indefinite and surrounded by paraphyses. Aeciospores in chains, globoid, with colorless walls. Uredinia erumpent, usually with paraphyses; urediniospores borne singly on pedicles. Telia erumpent, usually definite and without paraphyses; teliospores two-celled or more by transverse septa with two or more lateral pores.

37. **Phragmidium Andersoni** Shear. I, II, III

Bull. Torr. Club, vol. 29, p. 453, 1902.

On *Potentilla fruticosa* L., Mount Eddy, Siskiyou County (Copeland).

38. **Phragmidium disciflorum** (Tode) James. 0, I, II, III
Fungi Meckl., vol. 1, p. 16, 1790; James. Contr. U. S. Nat. Herb., vol. 3, p. 276, 1895.

On cultivated roses of the hybrid perpetual class, common throughout the state.

39. **Phragmidium imitans** Arthur. I, II, III
N. A. Flora, vol. 7, p. 165, 1912.

On *Rubus leucodermis* Dougl., Sisson, Shasta Springs, Yosemite Valley and Rionido; on cultivated varieties of raspberry rather frequent and sometimes destructive.

40. **Phragmidium Ivesiae** Sydow. I, II, III
Ann. Mycologici, vol. 1, p. 329, 1903.

On *Potentilla Blaschkeana* Turcz., Sisson, Lake Tahoe, Lassen County (Davy); on *P. glandulosa* Lindl., Modoc County (Meinicke); on *P. Hallii* Rydb., Lake Tahoe (Holway); on *P. Elmeri* Rydb., Donner Lake (Heller).

41. **Phragmidium montivagum** Arth. 0, I, II, III
Torreya, vol. 9, p. 24, 1909.

On *Rosa gymnocarpa* Nutt., Pine Ridge, Fresno County (Hall and Chandler).

42. **Phragmidium occidentale** Arthur. 0, I, II, III
Greene, Plantae Bakerianae, vol. 2, p. 3, 1901.

On *Rubus parviflorus* Nutt., Shasta Springs, Los Gatos, Berkeley, Mount Tamalpais, Rionido, Yosemite Valley, and Lake Tahoe.

43. **Phragmidium Rosae-californicae** Diet. I, II, III
Hedwigia, vol. 44, pp. 125, 333, 1904.

On *Rosa californica* Cham. and Schl., *R. gymnocarpa* Nutt., *R. sonomensis* Greene, and *R. minutifolia* Englm. Of frequent occurrence throughout the Coast Ranges. The aecia produce hypertrophy of the young shoots early in the season; later they appear on the mature leaves, which they injure but little.

PILEOLARIA CAST.

Obs., vol. 1, p. 22, 1842.

Uredinia erumpent, with paraphyses; urediniospores borne singly on pedicels, walls colored. Telia erumpent, definite; teliospores borne on pedicels, one-celled, flattened laterally, wall deeply colored, very verrucose.

44. **Pileolaria Toxicodendri** (Berk. and Rav.) Arthur. 0, II, III
Grevillea, vol. 3, p. 56, 1874; Arthur, N. A. Flora, vol. 7, p. 147, 1907.

On *Rhus diversiloba* T. and G., common in the Coast Ranges, Catalina Island (Bartholomew).

POLYTHELIS ARTHUR

Résult. Sci. Cong. Bot. Vienne, p. 341, 1906.

Telia erumpent, definite, without peridium. Teliospores forming heads attached by fragile pedicels to a common stalk, which is inconspicuous; two-celled by a transverse septum, easily separating at the septum.

45. **Polythelis Thalictri** (Chev.) Arthur. 0, III
Chev., Fl. Paris., vol. 1, p. 417, 1826; Arthur, Résult. Sci. Cong. Bot. Vienne, p. 341, 1906.

On *Thalictrum Fendleri* Englm., Lake Tahoe.

PUCCINIA PERS.

Sp. Pl., vol. 6, p. 67, 1825.

Aecia erumpent, cupulate, or cylindrical; aeciospores in chains, globoid or ellipsoid, wall colorless. Uredinia erumpent definite, without peridium; urediniospores borne on pedicels, wall colored, echinulate or verrucose. Telia erumpent, sometimes long covered by the epidermis; teliospores two-celled; wall colored, with a single pore to each cell.

TELIA ON GRAMINACEAE

46. **Puccinia abundans** (Pk.) Jackson. I, III
Mem. Brooklyn Bot. Gard., vol. 1, p. 229, 1918.

The aecial stage of this species (*Aecidium abundans* Pk.) is occasionally found on *Symphoricarpos racemosus* Michx., Berkeley, Santa Rosa.

Telia not definitely reported from California but to be expected on species of *Festuca*.

47. **Puccinia adspersa** Diet. and Holw. II, III
Erythea, vol. 3, p. 81, 1895.

On unknown grass, Modoc County (F. P. Nutting). This species seems to differ but little if at all from *Puccinia Clematidis* (DC) Lagerh.

48. **Puccinia anomala** Rostr. I, II, III

Thüm, Myc. Univ., no. 831.

Aecia, not reported from California, but in Russia on species of *Ornithogalum* (Mycol. Cent., vol. 4, p. 70, 1914).

Uredinia and telia on *Hordeum vulgare* L., Davis (L. R. Jones).

49. **Puccinia Aristidae** Tracy. II, III

Jour. of Mycol., vol. 9, p. 281, 1893.

On *Aristida bromoides,* Waterman's Hot Springs, San Bernardino County (Parish).

50. **Puccinia Hordei** Fuckel. II, III

Jahrb. Ver. Nat. Nassau, vol. 15, p. 16, 1860.

Uredinia and telia on *Hordeum murinum* L., Berkeley, San Diego, and Long Beach (Bethel); on *H. Gussonianum* Parl., Los Angeles (Bethel).

51. **Puccinia Clematidis** DC, Lagerh. I, II, III

Troniso Mus. Parsh., vol. 17, p. 47, 1895.

Aecia on *Clematis lasiantha* Nutt. and *C. ligusticifolia* Nutt. (*Aecidium Clematidis* DC), Berkeley, Atlas, Napa County, and Sisson, Mount Wilson (Bethel); on *Aquilegia truncata* F. and M. (*Aecidium Aquilegiae* Pers.), Berkeley, Acorn, Humboldt County; on *Clematis pauciflora* Nutt., San Diego County (LeRoy Abrams); on *Thalictrum Fendleri,* Lake Tahoe.

Uredinia and telia on *Bromus villosus* Forst., Berkeley, Ukiah, Ontario, San Bernardino, Long Beach (Bethel); on *B. hordaceus* L., San Diego (Bethel); on *B. carinatus* H. and A., Catalina Island (Bethel); on *B. marginatus* Nee., Willits (Hitchcock); on *Elymus triticoides* Buckl. Catalina Island (Bethel); on *E. condensatus* Presl. (Bethel); on *E. glaucus* Buckl., Campbell (H. B. Humphrey), and near Mount Shasta (E. Palmer).

52. **Puccinia Cynodontis** Desm. II, III

Exsiccati, vol. 3, no. 655.

Uredinia on *Cynodon dactylon* Pers., Sacramento, Anaheim; "very common throughout southern California" (Bethel). Telia produced only during the winter season.

53. **Puccinia Epicampis** Arthur. II, III

Bull. Torr. Bot. Club, vol. 33, p. 662, 1901.

On *Epicampes ringens* Benth., San Diego (Bethel).

54. **Puccinia Fendleri** (Tracy and Earle) Jackson. I, III

Mem. Brooklyn Bot. Gard., vol. 1, p. 246, 1918.

Aecia (*Aecidium Fendleri* Tracy and Earle) on *Berberis pinnata* Lag., Berkeley. Collected but once and but poorly developed. This was formerly taken to be the aecial stage of *Uropyxis sanguinea* (Erythea, vol. 3, p. 131, 1895) and its specific identity is still an open question.

Telia not reported from California but to be expected on species of *Koeleria.*

55. **Puccinia glumarum** (Schmidt) Erikss. and Henn. II, III

Zeitschr. f. Pflanzenkr., vol. 4, p. 1917, 1894.

On *Hordeum murinum* L., near Tehachipi (A. G. Johnson). This is one of the most destructive grain rusts in Europe but apparently it is not common in California. See Humphrey and Johnson, Phytopath., vol. 6, p. 80, 1916.

56. **Puccinia graminella** (Spez.) Diet. and Holw. I, III

Erythea, vol. 3, p. 80, 1895.

On *Stipa eminens* Cav., Berkeley. This is the only rust which produces its aecia on a grass; the aecia are easily overlooked.

57. **Puccinia Holcina** Erikss. II, III

Ann. Sci. Nat., sér. 8, vol. 9, p. 274, 1899.

Uredinia on *Notholcus lanatus* (L) Nash, extremely common in the bay region, Humboldt County, southern California (Bethel)..

58. **Puccinia interveniens** (Pk.) Bethel comb. nov. 0, I, III

Pk. Bull. Torr. Bot. Club, vol. 29, p. 74, 1883.

Aecia (*Aecidium roestilioides* Ell. and Ev.) on *Sidalcea malvaeflora* (Moc. and Sesse) Gray, Oakland Hills, Mount Tamalpais, San Francisco, Pasadena (McClatchie), San Diego, Monterey, and Julian (Bethel); on *S. asprella* Greene, Butte County (Heller); on *Malvastrum Thurberi* Gray, San Diego and San Jacinto (Bethel); on *M. ambigua,* Victorville and Granite Mountain, near Julian (Bethel).

Telia (*Puccinia Burnettii* Griff.) an *Stipa pulchra* Hitch., Santa Cruz (Griffiths); on *S. speciosa,* Victorville and Granite Mountain (Bethel); on *S.* sp., Mill Valley and San Diego (Bethel); on *Oryzopsis hymenoides* Ricker, Victorville (Bethel).

The connection between these forms has been established by Bethel by repeated cultures with both telia and aecia, the first being made in Colorado in 1912. His numerous collections of both aecia and telia in 1916 and 1918 in southern California, not far from the type locality of *Roestelia interveniens* establish the validity of the combination given above. The aecia have very short peridia, split almost to the base, as in the form genus *Roestilia;* the telia form sori from one to three inches in length, especially on the sheaths, which are tardy in rupturing.

59. **Puccinia luxuriosa** Sydow. II, III

Monogr. Ured., vol. 1, p. 812, 1904.

On *Sporobolus airoides* Torr., Lakeside, Riverside County (Bethel).

60. **Puccinia Majanthae** (Schrum.) Arth. and Holw. 0, I, II, III

Bull. Lab. Nat. Hist. Iowa, vol. 5, p. 188, 1901.

Aecia not reported from California but elsewhere on species of *Polygonatum* and *Convallaria.*

Uredinia and telia on *Phalaris minor* Retx., Long Beach (Bethel) and Palo Alto (Thomson); on *P. californica* H. and A., Montara Point, San Mateo County (Copeland).

61. **Puccinia montanensis** Ellis. I, II, III

Jour. of Mycol., vol. 7, p. 274, 1883.

Aecia on *Hydrophyllum capitatum* Dougl. and *H. occidentale* Gray (*Aecidium Hydrophyllae* Peck.), Humboldt and Mendocino counties, Amador County (Hansen); on *Phacelia californica* Cham. and *P. nemoralis* Greene (*Aecidium Phaceliae* Peck), Berkeley; on *Phacelia tanacetifolia* Benth., Carmel.

Telia on *Hordeum nodosum* L., Catalina Island (Bethel).

62. **Puccinia Poarum** Niels. II, III

Bot. Tids., vol. 2, p. 26, 1877.

Uredinia on *Poa annua* L., and *P. pratensis* L., Berkeley, Long Beach (Bethel).

Telia not reported from California.

63. **Puccinia poculiformis** (Jacq.) Wettst.
Verhl. Zool. Ges. Vienne, vol. 35, p. 544, 1885.

Aecia on species of Berberis, but not reported from California.

Uredinia and telia on *Avena fatua* L., *A. barbata* Brot., and *A. sativa* L.; on *Hordeum murinum* L., *H. Gussonianum* Parl. and *H. sativum* Jessen; on *Phleum pratense* L.; on *Agrostis alba* L. and *A. diegoensis* Vas.; on *Elymus condensatus* Presl.; on *Lamarckia aurea* Moench; on *Dactylis glomerata* L.; on *Panicularia pauciflora* (Presl.) Kze. Frequent throughout the state. This is the "black stem rust" found especially on the culms of oats, and in some seasons decidedly destructive. It includes several well defined biological forms, which are discussed by Stakeman and Piemeisel (Phytopathology, vol. 6, p. 99, 1918).

64. **Puccinia procera** Diet. and Holw. II, III
Erythea, vol. 1, p. 249, 1893.

On *Elymus condensatus* Presl., Pasadena (McClatchie), Berkeley, Long Beach, and San Diego (Bethel).

65. **Puccinia purpurea** Cke. II, III
Grevillea, vol. 5, p. 15, 1879.

On *Andropogon sorghum* var. *halepensis* L., Gilroy, Santa Ana (Bethel).

66. **Puccinia Rhamni** (Pers.) Wettst. I, II, III
Ver. zool.-bot. Ges. Wien, p. 544, 1885.

Aecia not reported from California, but to be looked for on species of *Rhamnus*.

Uredinia and telia on *Polypogon monspeliensis* Desf., Berkeley, Humboldt County, Ontario, Santa Barbara; on *Avena barbata* Brot., San Diego (Bethel); on *Lamarckia aurea* Moench, Los Angeles (Bethel) on *Lolium perenne* L., and *L. multiflorum* Lam., Long Beach (Bethel).

67. **Puccinia sejuncta** Sydow. 0, I, II, III
Ann. Mycologici, vol. 1, p. 326, 1903.

Aecia on *Hieracium* sp., Sisson (Holway).

68. **Puccinia Sorghi** Schw. II, III
Trans. Am. Philos. Soc., ser. 2, vol. 4, p. 295, 1832.

On *Zea mays* L., frequent but not destructive.

69. **Puccinia Stipae** (Opiz.) Arth. 0, I, II, III
Bull. Iowa Agri. Coll., p. 160, 1884.

Aecia not definitely reported from California, but this stage is known to occur on nine different chicoriaceous and carduaceous genera (Bethel, Phytopathology, vol. 6, p. 99, 1916).

Uredinia and telia on *Stipa setigera* Presl., Berkeley; on *S. pulchra* Hitch., San Diego, Coronado Island, and Long Beach (Bethel); on *S. eminens Andersoni* Vassey, San Diego (Bethel); on *Oryzopsis hymenoides* Ricker, Victorville (Bethel).

70. **Puccinia subnitens** Dietel. I, III
Erythea, vol. 3, p. 81, 1895.

Aecia on *Spergularia Clevelandii* (Greene) Robinson, Long Beach; on *S. macrotheca* (Hornem) Heynh; on *Thelypodium laciniatum* Endl. and *Heliotropium curassavicum* L., Lassen County (Davy); on *Abronia pinetorum* Jepson, San Jacinto (Bethel); on *Isomeris arborea* Nutt., San Diego (Jones). Shown by Bethel (Phytopathology, vol. 7, p. 92, 1917) to develop on eighty-five different species of host plants, representing fifty-two genera and nineteen families.

Telia on *Distichlis spicata* Greene, Redwood City, "common from Los Angeles to San Diego," San Jacinto (Bethel).

71. **Puccinia Triticina** Erikss. II, III
Ann. Sci. Nat., sér. 8, Bot., vol. 9, p. 270, 1899.

Frequent on certain varieties of wheat, Berkeley, San Francisco, Anaheim, Long Beach (Bethel). It is closely related to *P. Clematidis*.

Telia on Cyperaceae

72. **Puccinia Asterum** (Schw.) Kern. I, II, III
Mycologia, vol. 9, p. 224, 1917.

Aecia on *Aster* sp., Lake Tahoe and Calaveras Co., Seabright (Mrs. Clemens); on *A. occidentalis*, Yosemite Valley (Bethel).

Telia on *Carex* sp., Lake Tahoe, Seabright (Mrs. Clemons).

73. **Puccinia atro-fusca** (Dudley and Thomson) Holway. II, III
Jour. of Mycol., vol. 10, pp. 55, 228, 1904.

On *Carex Douglasii* Bott. and *C. usta* Bailey, San Bernardino County (Dudley and Thompson). This species is peculiar in that it produces large numbers of amphispores, and hence was first placed in the genus *Uromyces*.

74. **Puccinia canaliculata** (Schw.) Lagerh. 0, I, II, III

Tromso Mus. Aarsh., vol. 17, p. 51, 1894.

Aecia on *Xanthium Canadense* Mill, Lakeside (Bethel).

Telia on *Cyperus esculentus* L., Long Beach and San Bernardino (Bethel).

75. **Puccinia Caricis** (Schum.) Rebent. 0, I, II, III

Fl. neomarch, p. 356, 1804.

Aecia on *Urtica gracilis holosericea* Jepson, Berkeley.

Uredinia and telia on *Carex obnupta* Bailey, Berkeley.

76. **Puccinia Eleocharidis** Arthur. III

Prelim. List Iowa Ured., p. 158, 1884.

On *Eleocharis montana* (H. B. K.) R. and S., Long Beach (Bethel).

77. **Puccinia Grossulariae** (Schum.) Lager. 0, I, II, III

Aecia on *Ribes divaricatum* Dougl., Berkeley, San Francisco, Sisson.

Telia not reported in California but probably present on species of *Carex*.

78. **Puccinia McClatchieana** Diet. and Holw. II, III

Erythea, vol. 2, p. 127, 1895.

On *Scirpus microcarpus* Presl., San Francisco, Pasadena (McClatchie).

79. **Puccinia obtecta** Peck. II, III

Bull. Buffalo Soc. Nat. Hist., vol. 1, p. 66, 1873.

On *Scirpus lacustris occidentalis* Wats., Sacramento; on *S. californicus* (Meyer) Britton and *S. Olneyi* Gray, Long Beach (Bethel); on *S. americanus* Pers., Escondido (Bartholemew).

80. **Puccinia patruelis** Arthur. I, II, III

Mycologia, vol. 1, p. 245, 1909.

Telia not reported in California, but probably present on species of *Agoseris* and *Crepis*.

Uredinia and telia on *Carex marcida* Boott., San Bernardino (Bethel and Parish).

81. **Puccinia Peckii** (De Toni) Kell. I, III
Jour. of Mycol., vol. 8, p. 20, 1902.

Aecia on *Onagra Hookeri* (T. and G.) Small, Yosemite Valley, Giant Forest, King's River Cañon (Holway), San Bernardino (Bethel).

Uredinia and telia on *Carex siccata* Dewey, Yosemite Valley (Bethel).

Telia on Liliaceae

82. **Puccinia Alliorum** (DC) Corda. I, II, III
Fl. franc., vol. 6, p. 82, 1815; Corda Icones, vol. 4, p. 12, 1840.

On *Allium serratum* Wats. type of *Puccinia Blasdalei* Diet. and Holw., Antioch and Mount Diablo; on *A. falcifolium* H. and A., Benicia (Bigelow).

Unlike the European *P. Alliorum* I and III are produced on the same plants.

83. **Puccinia Asparagi** DC. 0, I, II, III
Fl. franc., vol. 2, p. 595, 1805.

On *Asparagus officinalis* L. Common throughout the state, and the source of large losses to growers. The life history and methods of combating it have been exhaustively studied by Professor R. E. Smith, Calif. Agr. Exp. Sta., Bulls. 165, 172.

84. **Puccinia Calochorti** Peck. I, III
Bot. Gaz., vol. 6, p. 228, 1881.

On *Calochortus albus* Dougl., Hoopa Valley; on *C. venustus* Benth., *C. Maweanus* Leichtl., Plumas County (Horne); on *C. bisceptrum* Wats., King's River Cañon, type of *Puccinia Holwayi* Diet. (Holway); on *C. elegans* Pursh., type of *Puccinia anachorita* Ell. and Hark. (Harkness).

85. **Puccinia granulispora** Ell. and Gall. I, II, III
Bull. Torr. Club, vol. 22, p. 61, 1895.

On *Allium precox* Brandegee, San Bernardino (Parish).

86. **Puccinia mesomegala** Berk. and Cooke. III
25th Ann. Rept. N. Y. State Mus., p. 111, 1873.

On *Clintonia uniflora* (Menzies) Knuth, Amador County (Hansen), and Siskiyou County (Meinicke).

87. **Puccinia Moreniana** Dudley and Thomson. III
Jour. of Mycol., vol. 10, p. 53, 1904.

On *Brodiaea capitata* Benth., Searsville Lake, San Mateo County (Dudley and Thompson).

88. **Puccinia nodosa** Ell. and Hark. II, III
Bull. Calif. Acad. Sci., vol. 1, p. 27, 1884.

On *Brodiaea capitata* Benth., Berkeley, Ukiah.

89. **Puccinia Veratri** Duby. I, II, III
Bot. Gall., vol. 2, p. 890, 1830.

Aecia not definitely reported from California, but known to develop on species of *Epilobium*.

Uredinia and telia on *Veratrum californicum* Durand, Placer County, Lake Tahoe, Yosemite Valley (Bethel), Modoc County (F. P. Nutting).

Telia on Iridaceae

90. **Puccinia Iridis** (DC) Wallr. II, III
Encyc., vol. 8, p. 224, 1808; Rabh. Krypt. Flora, vol. 1, p. 23, 1844.

Uredinia on *Iris longipetala* Herb., *I. Douglasiana* Herb., *I. missouriensis* Nutt., common in the Coast Ranges. Occasionally found on certain cultivated varieties of *I. germanica*, *I. xiphium* L., *I. alata* Poir., and *I. pumila*. Telia very rare.

Telia on Santalaceae

91. **Puccinia Comandrae** Peck. III
Bull. Torr. Club, vol. 11, p. 49, 1884.

On *Comandra umbellata* (L) Nutt., Shasta Springs, Fresno County (Holway).

Telia on Aristolochiaceae

92. **Puccinia Asarina** Kze. III
Kunze and Schmidt, Mykol., vol. 1, p. 70, 1817.

On *Asarum Lemmoni* Wats., Sisson, King's River Cañon (Holway); on *A. caudatum* Lindl., Olema.

93. **Puccinia Cynanchi** Lagerh. III
Biol. Soc. Brot., p. 129, 1889.

On *Funastrum hirtellum* (Gray) Schltr., Palm Springs (Parish).

Telia on Polygonaceae

94. **Puccinia Acetosae** (Schum.) Koern. II, III
Hedw., vol. 15, p. 184, 1876.

On *Rumex occidentale* Wats., and *R. acetosella* L., Berkeley; on *R. persicarioides* L., Long Beach (Bethel).

95. **Puccinia amphispilusa** Diet. and Holw. II, III
Erythea, vol. 3, p. 79, 1895.

On *Polygonum Davisiae* Brewer, Lake Tahoe; on *P. Newberryi*, Lassen County, type collection (F. P. Nutting).

96. **Puccinia Bistortae** (Str.) DC. II, III
Fl. franc., vol. 6, p. 61, 1815.

On *Polygonum bistortoides* (Pursh.) Small, Sherwood, Mendocino County, King's River Cañon (Holway).

97. **Puccinia Polygoni-amphibii** Pers. 0, I, II, III
Syn. Method. Fung., p. 227, 1801.

Aecia not reported from California but found in Europe on species of Geranium. Uredinia and telia on *Polygonum Muhlenbergii* Wats., San Francisco, Los Gatos, Victorville (Bethel); on *P. lapathifolium* L., San Bernardino (Parish); on *P. acre* H. B. K., Berkeley, San Mateo County (Baker); on *P. amphibium* L., Palo Alto (Scherfee); on *P. hydropiperoides* Michx., Los Angeles County (LeRoy Abrams).

98. **Puccinia punctiformis** Diet. and Holw. II, III
Erythea, vol. 2, p. 128, 1894.

On *Rumex salicifolius* Weinn., Berkeley, type collection; on *R. hymenosepalus* Torr., Berkeley, in cultivation.

Telia on Chenopodiaceae

99. **Puccinia Dondiae** Arthur. II, III
Bull. Torr. Bot. Club, vol. 42, p. 592, 1915.

On *Dondia intermedia* (Wats.) Heller, San Diego (Marcus E. Jones).

TELIA ON CRUCIFERAE

100. **Puccinia Holboellii** (Hornem) Rostr. III

Fl. Danica, vol. 37, p. 11, 1840; Rostr. Fungi Groen., p. 34, 1886.

On *Arabis Holboelli* Hornem, Yosemite Valley, Pasadena, type of *Puccinia palefaciens* Diet. and Holw. (McClatchie), San Diego County (Bethel); on *A. Breweri* Wats., Mount Diablo (Bioletti); on *A. arcuta* Gray, King's River Cañon (Holway); on *A. perennans* Wats., San Bernardino (Parish).

TELIA ON RANUNCULACEAE

101. **Puccinia Delphinii** Diet. and Holw. III

Hedwigia, vol. 32, p. 29, 1893.

On *Delphinium* sp., King's River Cañon (Holway).

102. **Puccinia gemella** Diet. and Holw. III

Sydow, Monogr. Ured., vol. 1, p. 541, 1903.

On *Caltha Howellii* Greene, reported from California by Holway (N. A. Ured., vol. 1, p. 6).

TELIA ON SAXIFRAGACEAE

103. **Puccinia Heucherae** (Schw.) Diet. III

Ber. deut. bot. Ges., vol. 9, p. 42, 1892.

On *Heuchera micrantha* Dougl. (*Puccinia congregata* Hark.), frequent in the Coast Ranges; on *Tellima grandiflora* (Pursh.) Dougl., Shasta Springs; on *Tellima affinis*, Mount Tamalpais (R. S. Gray).

TELIA ON CRASSULACEAE

104. **Puccinia Rhodiolae** B. and Br. III

Ann. Mag. Nat. Hist., ser. 2, vol. 5, p. 452, 1850.

On *Sedum* sp., King's River Cañon (Holway).

TELIA ON RHAMNACEAE

105. **Puccinia Mesnieriana** Thüm. III

Mycotheca Universalis, vol. 9, p. 834, 1877.

On *Rhamnus crocea* Nutt., Ukiah, Napa County, Pasadena (McClatchie); Fresno County (Holway), San Diego (Parish), Santa Barbara, and Yosemite Valley (Bethel), Mount Tamalpais (Harkness), type of *Puccinia digitata* Ell. and Hark.; on *R. ilicifolius* Kellogg, Mount Diablo; on *R. insularis* Kellogg, Claremont (Baker).

TELIA ON MALVACEAE

106. **Puccinia lobata** B. and C. III
Grevillea, vol. 3, p. 54, 1874.

On *Sida hederacea* (Dougl.) Torr., Holtville, Imperial County, Long Beach (Bethel).

107. **Puccinia Malvacearum** Bertero. III
Gay, Hist. de Chille, vol. 8, p. 43, 1852.

On *Malva borealis* Wallm., *M. parviflora* L. and *Althea rosea* Cav., common throughout the state; on *Sida hederacea* (Dougl.) Torr., Suisun (Davy). At the Botanic Garden of the University of California has been found on *Malva moschata* Linn., *M. sylvestris* L., *M. crispa* L., *M. oxyloba* Boiss., *Lavatera maritima* Gouan, *L. arborea* L., *L. sylvestris* Brot., *L. pleviea* Sims, and *L. assurgentifolia* Kell.

108. **Puccinia Sherardiana** Koern. III
Hedwigia, vol. 16, p. 19, 1877.

On *Malvastrum Thurberi* Gray, Fresno County (Holway), San Diego, and San Jacinto (Bethel); on *M. splendidum* Kellogg, Claremont (Baker); on *Sidalcea spicata* Greene, Lake Tahoe (Bethel).

109. **Puccinia Sphaeralceae** Ell. and Ev. I, III
Am. Naturalist, p. 428, 1879.

On *Sidalcea* sp., Humboldt County.

TELIA ON VIOLACEAE

110. **Puccinia effusa** Diet. and Holw. 0, I, III
Erythea, vol. 3, p. 81, 1895.

On *Viola lobata* Benth., Dunsmuir (Holway).

111. **Puccinia Violae** (Schum.) DC. 0, I, II, III
Pl. Saell., vol. 3, p. 224, 1803; Fl. franc., vol. 6, p. 62, 1915.

On *Viola nephrophylla* Greene and *V. adunca longipes* Sisson; on *V. glabella* Nutt., Sherwood; on *V. ocellata* T. and G., Ukiah.

TELIA ON ONAGRACEAE

112. **Puccinia Circaeae** Pers. III
Tent. Disp. Meth. Fung., p. 39, 1797.

On *Circaea pacifica* Aschers and Magnus, Sisson and Weitchpec, Trinity County.

113. **Puccinia Epilobii-tetragoni** (DC) Wint. 0, I, II, III
Rabh. Krypt. Flora, vol. 1, p. 214, 1884.

On *Epilobium franciscanum* Barbey, San Francisco, and Olema; on *E. paniculatum* Nutt., Rionido and Los Gatos, Pasadena (McClatchie), San Mateo County (Thomson); on *E.* sp., King's River Cañon, type of *Puccinia intermedia* Diet. and Holw.

114. **Puccinia Gayophyti** Billings. I, II, III
Bot. Gaz., vol. 7, p. 56, 1882.

On *Gayophytum diffusum* T. and G., Sisson, Calaveras Big Trees (Dudley); on *G. pumilum* Wats., Mount Eddy (Heller); on *G. ramossissimum* T. and G. (Harkness).

115. **Puccinia heterantha** Ell. and Ev. 0, I, II, III
Erythea, vol. 1, p. 204, 1893.

On *Taraxia ovata* (Nutt.) Small, Berkeley and Atlas, Napa County; on *T. graciliflora* (H. and A.) Small (A. Kellogg and W. G. W. Harford). The aecia appear very early in the spring and cause hypertrophy and ultimate destruction of the first leaves. The uredinia and telia appear later and are less destructive. The genetic relation between the two stages was shown by the writer (Rep. Calif. Exp. Sta., p. 227, 1894).

116. **Puccinia Ludwigiae** (Ell. and Ev.) Holw. 0, I, III
Proc. Phil. Acad. Sci., p. 153, 1893; Holway, N. A. Ured., vol. 1, p. 72, 1907.

On *Ludwigia natans* Ellis, San Bernardino (Parish).

117. **Puccinia Oenotherae** Vize. II, III
Grevillea, vol. 5, p. 109, 1877.

On *Clarkia elegans* Dougl., *C. concinna* (F. and M.) Greene, and *C. rhomboidea* Dougl., type of *Puccinia Clarkiae* Peck. On *Godetia rubicunda* Lindl., *G. amoena* Don., *G. biloba* (Durand) Wats., *G. grandiflora* Lindl. On *Boisduvalia densiflora* (Lindl.) Wats. and *B. sparsiflora* Heller, type of *Puccinia Boisduvaliae* Peck. On *Eulobus californicus* Nutt., type of *Puccinia Eulobi* Diet. and Holw. On *Oenothera strigulosa* T. and G. and *O. gauraeflora* T. and G. On *Sphaerostigma spirale* (Lehm) Walp., *S. hirtella* (Greene) Small, *S. viridescens* (Lehm) Walp., *S. micrantha* (Hornem) Walp., and *S. Veitchianum* (Hook) Small. Widely distributed and of frequent occurrence.

118. **Puccinia Zauschneriae** Sydow. I, II, III
Monogr. Ured., vol. 1, p. 436, 1906.

On *Zauschneria californica* Presl., common in the bay region and Coast Ranges. The aecial stage produces witches' brooms which soon wither away.

Uredinia and telia appear much later and are scarcely distinguishable from those of *Puccinia Oneotherae*. This species together with the forms included under numbers 113, 114, and 115 are considered forms of *P. Oenotherae* by G. R. Bisby (Am. Jour. Bot., vol. 3, p. 527, 1916).

TELIA ON UMBELLIFERAE

119. **Puccinia asperior** Ell. and Ev. I, III
Bull. Washb. Lab., vol. 1, p. 3, 1884.

On *Leptotaenia dissecta* Nutt., Ukiah.

120. **Puccinia Cicutae** Lasch. II, III
Klotzsch Herb. Mycol., no. 787, 1845.

On *Cicuta Bolanderi* Wats., Suisun, Pajaro (Thompson); on *C. virosa* var. *californica* C. and R., San Francisco; on *C. occidentalis* Dougl., Sisson.

121. **Puccinia Cymopteri** Diet. and Holw. I, III
Bot. Goz., vol. 18, p. 255, 1893.

On *Cymopterus teribinthium* (Hook) T. and G., King's River Cañon (Holway).

122. **Puccinia Ellisi** De-Toni. II, III
Saccardo, Syllogi Fungorum, vol. 7, p. 651, 1888.

On *Angelica tomentosa* Wats., type of *Puccinia Bakeriana* Arthur, Palo Alto (Baker).

123. **Puccinia Hydrocotyle** (Link) Cke. II, III
Spec. Plant., vol. 6, p. 22, 1825; Grevillea, vol. 9, p. 14, 1880.

On *Hydrocotyle prolifera* Kell., San Mateo County (Thompson), San Bernardino (Parish), Pacific Grove (Mrs. Clemens).

124. **Puccinia Jonesii** Peck. I, III
Bot. Gaz., vol. 6, p. 226, 1881.

On *Peucedanum dasycarpum* T. and G., Mount Diablo, Palo Alto (Thompson), on *P. Hassei* C. and R., Atlas, Napa County.

125. **Puccinia Lindrothii** Sydow. I, III
Acta Soc. Fauna et Flora Fennica, vol. 22, p. 62, 1902.

On *Drudeophytum Hartwegii* (Gray) C. and R., Berkeley; on *Velaea arguta* (F. and G.) C. and R., Mount Lowe (Bethel).

126. **Puccinia Osmorrhizae** (Peck) Cke. and Peck. 0, I, II, III
Rep. N. Y. State Mus., vol. 24, p. 92, 1872; vol. 29, p. 73, 1878.

On *Osmorrhiza nuda* Torr. and *O. occidentalis* (Nutt.) Torr., common in the Coast Ranges, Calaveras County (Dudley), King's River Cañon (Holway); on *O. brevipes*, Sonoma County (Heller).

Telia on Primulaceae

127. **Puccinia melanconioides** Ell. and Hark. I, II, III
Bull. Calif. Acad. Sci., no. 1, p. 27, 1884.

On *Dodecatheon Hendersonii* Gray, common throughout the state; on *D. Jeffreyi* Van Houtte, San Bernardino Mountains (Parish).

Telia on Gentianaceae

128. **Puccinia Gentianae** (Str.) Link. II, III
Spec. Plant, vol. 2, p. 73, 1824.

On *Gentiana oregana* Englm., Mount Tamalpais; on *G. Menziesii* Griseb., Mendocino County (Davy).

Telia on Convolvulaceae

129. **Puccinia Convolvuli** (Pers.) Cast. I, II, III
Cat. Pl. Marseilles, p. 202, 1845.

On *Convolvulus luteolus* Gray and *C. subacaulis* Gray, common throughout the bay region; on *C. occidentalis* Gray, Pasadena (McClatchie).

130. **Puccinia Cressae** (DC) Lagh. I, II, III
Biol. Soc. Brot., p. 131, 1889.

On *Cressa cretica* L., Napa County, Calaveras County, Lassen County (Davy), Catalina Island (McClatchie), Mountain View (Thompson), southern California (Bethel).

131. **Puccinia Dichondrae** Mont. I, III
Gay, Fl. Chil., vol. 8, p. 46, 1853; also Syll. Crypt., p. 313, 1856.

On *Dichondra repens*, Forst., San Diego and Orange County (M. E. Jones).

Telia on Polemoniaceae

132. **Puccinia Giliae** Hark. II, III
Bull. Calif. Acad. Sci., no. 1, p. 34, 1884.

On *Linanthus ciliatus* (Benth.) Greene, Mount Diablo (Harkness); on *Collomia grandiflora* Dougl., Sisson; on *Gilia gilioides* (Benth.) Greene, Tuolumne County; on *G. capitata* Dougl., Klamath River, Humboldt County (H. P. Chandler); on *Navarretia atractyloides* (Benth.), H. and A., Pasadena (McClatchie).

133. **Puccinia plumbaria** Peck. I, III
Bot. Gaz., vol. 6, p. 238, 1881.

On *Microsteris gracilis* (Dougl.) Greene, Mendocino County; on *Linanthus ciliatus* (Benth.) Greene, Calaveras County; on *Gilia californica* Benth., Snow Mountain, type of *Puccinia gilicola* Hennings (Purpus).

Telia on Boraginaceae

134. **Puccinia Cryptanthis** Diet. and Holw. II, III
Erythea, vol. 1, p. 249, 1893.

On *Cryptanthe Torreyana* (Gray) Greene, Fresno County (Holway); on *C. flaccida* (Lehm) Greene, Fresno County (Holway).

Telia on Labiateae

135. **Puccinia distorta** Holway. II, III
Ann. Mycol., vol. 3, p. 20, 1905.

On *Hyptis Emoryi* Torr., Palm Springs (Parish).

136. **Puccinia mellifera** Diet. and Holw. I, III
Erythea, vol. 1, p. 25, 1893.

On *Salvia mellifera* Benth., Pasadena (McClatchie), San Jacinto and Santa Barbara (Bethel); Carmel (Mrs. Clemens); on *Audibertia Palmeri* Gray, San Jacinto (Bethel).

137. **Puccinia Menthae** Pers. I, II, III
Synopsis Fung., p. 227, 1801.

On *Mentha canadensis* L., Suisun, San Bernardino (Parish), San Ysidero (Bartholomew); on *M. sativa* L., Pajaro (Thompson); on *Micromeria Chamissonis* (Benth.) Greene, common in the bay region, type of *Puccinia Micromeriae* Dudley and Thompson. On *Monardella*

villosa Benth., common in the Coast ranges, type of *Puccinia Monardellae* Dudley and Thompson; on *M. odoratissimum* Benth., Lake Tahoe; on *M. lanceolata* Gray, Grass Valley (C. J. Wright); on *M. viridis* Jepson, Napa County; on *M. micrantha* Gray, San Bernardino (Parish).

TELIA ON SOLANACEAE

138. **Puccinia Chamaesarachae** Sydow. I, III

Ell. and Ev., N. A. Fungi, no. 1476; Sydow, Monogr. Ured., vol. 1, p. 263, 1902.

On *Chamaesarache nana* Gray, Truckee (Bethel).

139. **Puccinia globosipes** Peck. II, III

Bull. Torr. Club, vol. 12, p. 34, 1885.

On *Lycium californicum* Nutt., San Pedro (McClatchie); on *L. Andersoni Wrightii* Gray, San Bernardino County (Parish).

TELIA ON SCROPHULARIACEAE

140. **Puccinia Adenostegiae** Arthur. III

Bull. Torr. Club, vol. 29, p. 231, 1902.

On *Adenostegia pilosa* Greene, Palo Alto (LeRoy Abrams); on *A. rigida* Jepson, San Diego County (Mrs. Brandegee).

141. **Puccinia Antirrhini** Diet. and Holw. II, III

Hedwigia, vol. 36, p. 298, 1899.

On *Antirrhinum majus* L., common in the bay region and southern California; on *A. Nuttallianum* Benth., San Bernardino (Parish); on *A. virga* Gray, Ukiah (Heller) and Lake County (Jepson). The writer has also found it possible to infect with this species plants of the native *A. vagans* Gray, and the exotic *A. assurgens, A. nudicum, Linaria amethystina, L. delphinifolia, L. bipartita, L. melanthera,* and *L. marocanna.* The "snapdragon rust" has been a troublesome pest in California for many years, and is reported to have appeared in the neighborhood of Chicago, in Ohio, and Indiana (Phytopathology, vol. 4, p. 400, 1914). It was first found by the writer at San Leandro in 1896.

142. **Puccinia Castillejae** (Diet. and Holw.) Arthur, comb. nov. II, III

Erythea, vol. 1, p. 247, 1893.

Uredinia (*Uredo Castilleiae* Diet. and Holw.) amphigenous, scattered, round or oval, 0.5 mm. across, early naked, pulverulent, light

cinnamon brown, ruptured epidermis, not evident; urediniospores broadly ellipsoid or globoid, 16–24 by 20–29μ; wall golden brown, thick, 2–3μ, moderately to closely echinulate, the pores 3, equatorial.

Telia not seen; teliospores broadly ellipsoid to ovoid, 18–23 by 23–29μ, rounded above, slightly narrowed below, slightly or not constricted at the septum; wall chestnut to dark golden brown, 2–3μ thick, moderately thickened at the apex, 5 to 7μ, smooth; pedicel colorless, short, fragile.

On *Castelleja foliolosa* H. and A., Berkeley, Coahuila Valley (Bethel).

143. **Puccinia Cordylanthi** Blasdale, sp. nov. II, III

Sori containing both urediniospores and teliospores, scattered, minute, rarely confluent, erumpent; urediospores globose or ellipsoid, cinnamon brown, with two or three germ-spores; teliospores oblong, not clavate nor constricted at the septum, apex not thickened; 15–24μ by 29–41μ, brown, pedicel short and hyaline.

On stems and leaves of *Cordylanthes filifolia* Nutt., collected by E. Bethel at Cajon Pass, San Bernardino County.

This species is more closely related to *P. Adenostegiae* Arth. than to *P. Anthirrhini* Diet. and Holw.; it differs from the latter in the characters of the sori, and from both in the form and size of the teliospores. These differences are shown in the figures given below, which represent the results of the measurement of forty mature spores of each of the three species.

	Average measurement	Extreme measurement
Puccinia Antirrhini	21.9 by 51.37μ	16–26 by 41–64μ
Puccinia Adenostegiae	21.75 by 42.33μ	18–29 by 32–49μ
Puccinia Cordylanthi	20.68 by 35.13μ	15–24 by 29–41μ

144. **Puccinia Palmeri** Diet. and Holw. III

Erythea, vol. 7, p. 98, 1899.

On *Penstemon confertus* Dougl., Lake Tahoe; on *P. Newberryi* Gray, Alpine County (Hansen).

145. **Puccinia Pentastemonis** Peck. III

Bull. Torr. Club, vol. 12, p. 35, 1885.

On *Pentstemon Roezli* Regel., Cisco (L. S. Smith); on *P. deustus* Douglas, Sloate, Plumas County (Horne); on *P. azureus* Benth., Kewville (Heller); on *P. Bridgesii* Gray, King's River Cañon (Holway).

146. **Puccinia rufescens** Diet. and Holw. I, III
Bot. Gaz., vol. 18, p. 253, 1893.

On *Pedicularis semibarbatus* Gray, Lake Tahoe, King's River Cañon (Holway), Mount San Antonio (McClatchie).

147. **Puccinia Wulfeniae** Diet. and Holw. III
Erythea, vol. 3, p. 79, 1895.

On *Synthyris rotundifolia* Gray, Ukiah.

Telia on Rubiaceae

148. **Puccinia punctata** Link. 0, I, II, III
Obs. Myc., *in* Ges. naturf. Freunde, Berlin, vol. 2, p. 30, 1816.

On *Galium aparine* L., Berkeley; on *G. triflorum* Michx., Sisson and Shasta Springs, type of *Puccinia chondroderma* Lindr.

149. **Puccinia rubifaciens** Johans. III
Bot. Centralbl., vol. 28, p. 394, 1888.

On *Galium californicum* H. and A., King's River Cañon (Holway).

Telia on Caprifoliaceae

150. **Puccinia Symphoricarpi** Hark. III
Bull. Calif. Acad. Sci., vol. 1, p. 35, 1884.

On *Symphoricarpos racemosus* Michx., very common in the bay region and the Coast Ranges.

Telia on Compositae

151. **Puccinia Absinthi** DC. II, III
Fl. franc., vol. 6, p. 56, 1815.

On *Artemisia heterophylla* Nutt., Berkeley, Los Gatos, Napa and Rionido; on *A. tridentata* Nutt., Lassen County (Davy) and Cajon Pass (Bethel); on *A. Suksdorfii* Piper, Los Gatos (Heller); on *A. dracunculoides* Pursh., San Jacinto (Bethel); on *A. elatior* (T. and G.) Rydberg, Visalia (Holway); on *A. Douglasiana* Bess., Santa Barbara (A. D. E. Elmer). This species is frequently included under *P. Tanaceti* DC, from which it differs but little.

152. **Puccinia Asteris** Duby. III
Bot. Gall., vol. 2, p. 888, 1830.

On *Aster chilensis* Nee., Berkeley; on *A. yosemitanus* Greene, Yosemite Valley.

153. **Puccinia Balsamorrhizae** Peck. II, III

Bull. Torr. Club, vol. 11, 49, 1884.

On *Belsamorrhiza sagittata* Nutt., Lake Tahoe, Amador County (Hansen), Lassen County (F. P. Nutting); on *B. deltoidea* Nutt., King's River Cañon (Holway).

154. **Puccinia Chrysanthemi** Roze. II, III

Bull. Soc. Mycol. Franc., vol. 17, p. 92, 1900.

On *Chrysanthemum indicum* DC, frequent throughout the state and sometimes a serious pest. Telia found but once in southern California by Bethel. This species is now widely distributed over Europe and North America. It was first observed by the writer at Berkeley in 1910.

155. **Puccinia Cirsii** Lasch. II, III

Rabh. Fungi Europ, No. 89, 1859.

On *Cirsium edule* Nutt. and *C. lanceolatum* (L) Scop., Berkeley; on *C. undulatum* (Nutt.) Spring, Antioch; on *C. Breweri* (Gray) Jepson, King's River Cañon, type of *Puccinia californica* Dietel and Holw. (Holway); on *C. occidentale* (Nutt.), Jepson, San Francisco; on *C. Drummondii acaulescens* (Gr.) Cov., King's River Cañon (Holway); on *C. quercetorum* (Gray) Jepson, Santa Cruz (Thompson).

156. **Puccinia conferta** Diet. and Holw. III

Erythea, vol. 1, p. 250, 1893.

On *Artemisia heterophylla* Nutt., King's River Cañon, type collection (Holway), Ukiah (Holway and Blasdale); on *A. californica* Less., Pasadena, type of *Puccinia recondita* Dietel (McClatchie).

157. **Puccinia crepidicola** Sydow. II, III

Oestr. bot. Zeitschr., vol. 51, p. 17, 1901.

On *Crepis pleurocarpa* Greene, Mount Eddy, Siskiyou County (C. F. Baker).

158. **Puccinia Crepidis-acuminatae** Sydow. II, III

Oestr. bot. Zeitschr., vol. 51, p. 27, 1901.

On leaves and stems of *Crepis acuminata* Nutt., King's River Cañon (Holway); on *C. pleurocarpa*, Siskiyou and Trinity counties (G. D. Butler).

159. **Puccia Franseriae** Sydw. II, III

Ann. Mycol., vol. 1, p. 326, 1903.

On *Franseria dumosa* Gray, Palm Springs.

160. **Puccinia Grindeliae** Peck. III

Bot. Gaz., vol. 4, p. 127, 1879.

On *Grindelia* sp., Julian, San Diego County (Bethel).

161. **Puccinia Harknessii** Vize. II, III

Grevillea, vol. 7, p. 11, 1878.

On *Lygodesmia spinosa* Nutt., Lassen County (Davy); on *Ptiloria exigua* Nutt., San Bernardino County (Parish).

162. **Puccinia Helianthellae** (Peck) Arthur. II, III

Bull. Torr. Club, vol. 31, p. 4, 1904.

On *Helianthella nevadensis* Greene, Nevada County (Heller); on *H. californica* Gray, Nevada County (M. E. Jones).

163. **Puccinia Helianthi** Schw. II, III

Syn. Fung. Carol., p. 73, 1822.

On *Helianthus annuus* L., frequent throughout the state; on *H. lenticularis* Dougl., Fresno County (Holway) and Pasadena (McClatchie); on *H. debilis* Nutt, in cultivation, Berkeley.

164. **Puccinia Hemizoniae** Ell. and Tracy. II, III

Jour. of Mycol., vol. 7, p. 43, 1891.

On *Hemizonia luzulaefolia* DC, Berkeley and Santa Rosa; on *H. Clevelandii* Greene, Santa Rosa; on *H. citrina* Greene, Marin County (Heller); on *Lagophylla congesta* Greene, Berkeley, type of *Puccinia Lagophyllae* Diet. and Holw.

165. **Puccinia Hypochoeridis** Oud. II, III

Nederl. Kruidk. Archief., (2), vol. 1, p. 175, 1872.

On *Hypochaeris glabra* L., Berkeley, San Francisco, Mount Diablo, Monterey (Bethel).

166. **Puccinia intermixta** Peck. I, III

Bot. Gaz., vol. 4, p. 231, 1879.

On *Iva axillaris* Pursh., Lassen County (Davy).

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167. **Puccinia investita** Schw. I, III

N. A. Fungi, no. 2932; Peck, Rep. N. Y. St. Mus., p. 117, 1872.

On *Gnaphalium chilense* Spreng, San Francisco; on *G.* sp., Mount Tamalpais (Bethel).

168. **Puccinia Millefolii** Fuckl. III

Symb. Myc., vol. 55, 1869.

On *Achillea millefolium* L., San Francisco (Bethel).

169. **Puccinia splendens** Vize. III

Grevillea, vol. 7, p. 11, 1878.

On *Hymenoclea salsola* T. and G., Mojave Desert (Parish); on *H. monogyra* T. and G. (Griffiths).

170. **Puccinia Stephanomeriae** Sydow. II, III

Monogr. Ured., vol. 1, p. 117, 1904.

On *Stephanomeria lactucina* Gray, Sisson; on *S. chicoriaceum* Gray, Pasadena (McClatchie), Mount Wilson (Bethel); on *S. runcinata*, Victorville (Bethel); on *Ptiloria carduacea*, Claremont (Baker).

171. **Puccinia Taraxaci** (Rebent) Plowr. II, III

Plowr. British Ured. and Ustilig., p. 186, 1889.

On *Taraxacum Taraxacum* (L), Karst., Berkeley and Sisson.

172. **Puccinia Troximontis** Peck. II, III

Bot. Gaz., vol. 6, p. 227, 1881.

On *Agoseris plebiea* Greene, Santa Rosa, Berkeley and San Francisco; on *A. barbellata*, Mount Eddy (Copeland); on *A. hirsuta* (Hook) Greene, Berkeley.

173. **Puccinia variolans** Hark. III

Bull. Calif. Acad. Sci., no. 1, p. 15, 1884.

On *Aplopappus squarrosus* H. and A., Pasadena (McClatchie); on *Tetradymia glabrata* Gray, Lassen County (Davy).

174. **Puccinia Wyethiae** (Peck) Ell. and Ev. II, III

Bot. Gaz., vol. 7, p. 46, 1882; Ell. and Ev., N. A. Fungi, no. 2987.

On *Wyethia angustifolia* Nutt., Berkeley and Ukiah, also Los Angeles, Long Beach, and San Ysidro (Bethel).

175. **Puccinia Xanthii** Schw. III
Syn. Fung. Carol, p. 73, 1822.

On *Xanthium canadense* Mill., San Francisco, Suisun, Fresno County (Holway), Pasadena (McClatchie), San Bernardino (Parish), Los Angeles, and Long Beach (Bethel).

PUCCINIASTRUM OTTH.

Mitth. nat. Ges. Bern, p. 71, 1861.

Aecial stage similar to that of the genus Coleosporium, on the leaves of species of *Pinus* and *Abies*. Urediniospores borne singly on pedicels, walls colorless. Telia indehiscent in layers in or beneath the epidermis. Teliospores usually prismatic, two- to four-celled.

176. **Pucciniastrum Goodyerae** (Tranz.) Arthur. II
Arthur, N. A. Flora, vol. 7, p. 105, 1907.

On *Goodyera Menziesii* Lindl., Mount Eddy (Copeland).

177. **Pucciniastrum pustulatum** (Pers.) Dietel. 0, I, II, III
Dietel, *in* Engler and Prant., Natürl. Pflanzenfam., vol. 1, p. 47, 1897.

The aecial stage not definitely known from California, but shown by Frazier (Mycologia, vol. 4, p. 175, 1912) to develop on *Abies balsamea* (L) Mill.

Uredinia and telia on *Epilobium franciscanum* Barbey; on *E. adenocaulon* Treal., *E. coloratum* Muhl., *E. holosericeum* Treal., and *E. californicum* Haussek. Common in the Coast Ranges. Uredinia found throughout the year.

178. **Pucciniastrum Pyrolae** (Pers.) Dietel. II, III
Gmel. Syst. Nat., vol. 2, p. 1474; Dietel, *in* Engler and Prant., Natürl. Pflanzenfam., vol. 1, p. 47, 1897.

On *Pyrola picta* Smith and *P. secunda* L., Sisson and Mount Tallac, Plumas County (Horne); on *Chimaphila umbellata* (L) Nutt., Siskiyou County (Meinicke).

179. **Pucciniastrum sparsum** (Wint.) Ed. Fischer. II, III
Rabh. Krypt. Flora, vol. 1, p. 245, 1881; Beiträg. Krypt. Schweiz., vol. 2, p. 469, 1904.

On *Arbutus Menziesii* Pursh., Mount Tamalpais, type of *Uredo Arbuti* Diet. and Holw.; on *Arctostaphylos patula* Greene, Sisson, type of *Uredo Copelandi* Sydow; on *A. Hookeri* Don., Antonio Station, Santa Barbara County (Brandegee).

RAVENELIA BERK.

Gard. Chron., p. 132, 1853.

Uredinia erumpent, without peridium; urediniospores borne singly on pedicels, wall colored. Teliospores fascicled on compound stalks, one- or two-celled, forming heads bordered by hyaline cysts.

180. **Ravenelia arizonica** Ell. and Ev. II, III

Bull. Torr. Club, vol. 22, p. 363, 1895.

On *Prosopis juliflora* (Sw.) DC, San Diego (Bethel).

181. **Ravenelia versatilis** (Peck) Diet. II, III

Hedwigia, vol. 33, p. 368, 1894.

On *Acacia Gregii* Gray, San Bernardino (Toumey), Banning (Parish).

TRANZSCHELIA ARTH.

Résult. Sci. Cong. Bot. Vienne, p. 340, 1906.

Aecia cylindrical; aeciospores globoid; wall colored. Uredinia erumpent; urediniospores borne singly on pedicels mixed with paraphyses. Telia erumpent, pulverulent; teliospores attached to a common stalk by short inconspicuous pedicels.

182. **Tranzschelia punctata** (Pers.) Arth. 0, I, II, III

Ann. Bot. Usteri, vol. 20, p. 135, 1796; Arthur, *op. cit.*

Aecia not known from California but found on various species of *Hepatica, Anemone* and *Thalictrum* (*Aecidium punctatum* Pers.) in the eastern United States.

Uredinia and more rarely telia on cultivated peach, plum, prune, almond, and apricot, especially in the southern part of the state, but widely distributed. This is the "prune rust" which is sometimes the source of considerable losses to fruit growers.

UREDINOPSIS MAGN.

Atti Cong. Bot. Geneva, p. 167, 1893.

Aecia similar to those of *Coleosporium*, found on leaves of species of *Abies*. Uredinia larger and more conspicuous than the aecia, the agglutinated spores ejected from the delicate peridium in a long mucilaginous filament. Telia indehiscent; teliospores four-celled, with thin wall.

183. **Uredinopsis Copelandii** Sydow. I, II, III
Ann. Mycologici, vol. 2, p. 34, 1904.

Aecia not definitely reported from California, but elsewhere on species of *Abies*.

Uredinia and telia on *Athyrium cyclosorum* Rupr., Sisson (Copeland).

184. **Uredinopsis Pteridis** Diet. and Holw. I, II, III
Ber. d. deut. bot. Gesell., Bd. 13, p. 331, 1895.

Aecia (*Peridermium pseudo-balsameum* Arthur and Kern) on *Abies grandis* Lindl., Eureka. Reported by Hedgcock (Mycologia, vol. 4, p. 141, 1912) on *A. lasiocarpa* Nutt., and *A. nobilis* Lindl.

Uredinia and telia on *Pteris aquilinum pubescens* Underwood. Sisson, Lake Tahoe, San Francisco, Mount Tamalpais, Pasadena (McClatchie), Long Beach (Bethel). For culture experiments relating to this form see Weir and Hubert (Am. Jour. Bot., vol. 4, p. 328, 1917).

UREDO

Under this form genus are grouped the uredinial stages of certain species for which the mature stages are unknown.

185. **Uredo Acaenae** Ell. and Ev.
N. A. Fungi, no. 3150, 1894.

On *Acaena tridactyla* Presl., frequent in the bay region. Arthur (N. A. Flora, vol. 7, p. 174) takes this to be uredinia of *Phragmidium Ivesiae Sydow.*

186. **Uredo Gaillardiae** Diet. and Holw.
Erythea, vol. 7, p. 98, 1899.

On *Gaillardia aristata* Pursh, Dunsmuir (Holway).

187. **Uredo Nicotianae** Arthur, sp. nov.

Uredinia mostly hypophyllus, scattered upon discolored areas 1 to 1.5 cm. across, round, 0.2 to 0.5 mm. in diameter, early naked, applanate, subepidermal, pulverulent, pale cinnamon to whitish, ruptured epidermis evident; urediniospores globoid to broadly ellipsoid, 23 to 26μ by 24 to 32μ; wall colorless, 1.5 to 5μ thick, closely and coarsely verrucose, the pores obscure.* Collected in small amount at Rionido on *Nicotiana Bigelowii* Wats. The spores resemble those of a *Coleosporium*, although not in well defined chains.

* This description furnished by Professor J. C. Arthur.

188. **Uredo Phoradendri** Jackson

Mem. Brooklyn Bot. Gard., vol. 1, p. 285, 1918.

On *Phoradendron longispicum* Trelease, Chico (C. C. Thomas).

189. **Uredo Sphacelicola** Diet. and Holw.

Erythea, vol. 1, p. 248, 1893.

On *Sphacele calycina* Benth., Mount Tamalpais.

UROMYCES UNGER

Exanth. Pfl., p. 277, 1833.

Aecia erumpent, cupulate, or cylindrical; aeciospores in chains globoid or ellipsoid, often angular. Uredinia definite and without paraphyses; urediniospores borne singly on pedicels; wall colored, usually echinulate. Telia erumpent or long-covered by the epidermis; teliospores one-celled, wall firm, deeply colored, thick.

TELIA ON GRAMINACEAE

190. **Uromyces Jacksonii** Arth. and Fromme. II, III

Torreya, vol. 15, p. 260, 1915.

On *Agrostis pallens* Trin., Atlas, Napa County; on *Hordeum nodosum* L, San Mateo County (Copeland).

191. **Uromyces Peckianus** Farlow. II, III

Proc. Am. Acad. Arts and Sci., p. 76, 1883.

Aecia on *Salicornia ambigua* Michx., *Chenopodium album* L., *C. murali* L., and *Atriplex* sp., Monterey (Bethel).

Uredinia and telia on *Distychlis spicata* Greene, Long Beach (Bethel), Ferndale (Davy and Blasdale). Probably common along the coast.

TELIA ON CYPERACEAE

192. **Uromyces Scirpi** (Cast.) Burr. 0, I, II, III

Cat. Pl. Marseilles, p. 214, 1845; Bot. Gaz., vol. 9, p. 188, 1884.

Aecia on *Oenanthe californica* Wats., central California.

Uredinia and telia on *Scirpus pacificus* Britton, and *S. californicus* (Mey.) Britt, Long Beach (Bethel); on *S. paludosus* Nels., Escondido (Bartholomew).

Telia on Juncaceae

193. **Uromyces Junci** (Desmaz) Tul. 0, I, II, III
Ann. Sci. Nat., sér. 4, Bot., vol. 2, p. 148, 1854.

Aecia on *Ambrosia psilostachya* DC, San Jacinto and Coahuila Valley (Bethel).

Uredinia and telia on *Juncus balticus* Willd., Long Beach, Cajon Pass, and Victorville (Bethel), Mohave C. (Parish); Catalina Island (Bethel); on *J. leseurii* Boland, Sunol (Horne), Pasadena (McClatchie); on *J. textilis* Buch., Cajon Pass (Bethel), Pasadena (McClatchie), San Bernardino County (Parish); on *J. patens* Mey., San Mateo County (Copeland); on *J. Mexicanus* Willd., San Diego County (Chandler).

194. **Uromyces Junci-effusi** Sydow. II, III
Monogr. Ured., vol. 2, p. 290, 1910.

On *Juncus Xiphioides* E. Meyer, Ukiah and Mill Valley; on *J. phaeocephalus* Engelm., Long Beach (Bethel); on *J. nevadensis* Wats.

Telia on Liliaceae

195. **Uromyces aureus** Diet. and Holw. I, III
Hedwigia, vol. 32, p. 30, 1893.

On *Allium validum* Wats., King's River Cañon, type collection (Holway).

196. **Uromyces bicolor** Ellis. 0, I, II, III
Contr. U. S. Nat. Herb., vol. 4, p. 231, 1893; Bull. Torr. Club, vol. 24, p. 282, 1897.

On *Allium unifolium* Kell., Berkeley (type collection for *Uromyces aterrimus* Diet. and Holw.) and Sherwood, Mendocino County; on *A. validum* Wats., Sisson and Lake Tahoe.

197. **Uromyces Brodieae** Ell. and Hark. I, III
Bull. Calif. Acad. Sci., no. 1, p. 28, 1884.

On *Brodiaea capitata*, Berkeley, Mount Diablo, Yosemite Valley.

198. **Uromyces Chlorogali** Diet. and Holw. I, II, III
Erythea, vol. 1, p. 246, 1893.

On *Chlorogalum pomeridianum* (Ker.) Knuth, Berkeley, Mount Diablo, Atlas, Napa County, Palo Alto (Thompson).

199. **Uromyces Lilii** Clinton. 0, I, II, III
27th Rept. N. Y. State Mus., p. 103, 1875.

On *Lilium columbianum* Hansen, Sisson and King's River Cañon, type of *Uromyces Holwayi* Lagh. (Holway); on *L. rubescens* Wats., Shasta Springs; on *L. parvum* Kellogg, Lake Tahoe; on *L. Washingtonianum* Kell., Forest, Lassen County (F. P. Nutting).

200. **Uromyces Zygadeni** Peck. 0, I, II, III
Bot. Gaz., vol. 6, p. 239, 1881.

On *Zygadenus Fremonti* Torr., Pasadena (McClatchie), San Mateo County (Thompson). On *Z. sp.*, Santa Monica Mountains (Holway).

Telia on Polygonaceae

201. **Uromyces intricatus** Cooke. 0, I, II, III
Grevillea, vol. 7, p. 3, 1878.

On species of *Eriogonum* (*Uromyces Eriogoni* Ell. and Hark.) and *Chorizanthe* (*Uromyces Chorizanthis* Ell. and Hark), very common throughout the state. Arthur (N. A. Flora, vol. 7, p. 245) reports it from *Eriogonum cernum* Nutt., *E. dumosum* Greene, *E. elongatum* Benth., *E. fasciculatum* Benth., *E. latifolium* Smith, *E. nudum* Dougl., *E. parvifolium* Smith, *E. vimineum* Dougl., *E. virgatum* Benth., *Chorizanthe cuspidata* Wats., *C. robusta* Parry, and *C. pungens* Benth.

202. **Uromyces Polygoni** (Pers.) Fuckl. I, II, III
Symb. Mucol., p. 64, 1869.

Aecia very rare but collected by Bethel on *Polygonum aviculare* L. at Long Beach and San Jacinto.

Uredinia and telia very common throughout the state on the same host; on *P. erectum* L., Escondido (Bartholomew).

Telia on Chenopodiaceae

203. **Uromyces Betae** (Pers.) Lev. 0, I, II, III
Pers. Syn. Fung., p. 220, 1801; Ann. Sci. Nat., sér. 3, Bot., vol. 8, p. 375, 1847.

Aecia not reported from California but found in Europe and Australia.

Uredinia very common throughout the state on *Beta vulgaris* L. and *B. chicla.*

Telia found occasionally, specially upon seed-bearing plants.

204. **Uromyces Chenopodii** (Duby) Schroet. I, II, III
Duby., Bot. gall., vol. 2, p. 899, 1830; Schroeter, Kunze, Fung. Sel., no. 214, 1880.

Aecia, uredinia, and telia on leaves and stems of *Dondia multiflora* (Torr.) Heller, Long Beach, San Diego, and Point Firmin (Bethel); on *D. californica* (Wats.) Heller, Laguna Beach (H. W. Fawcett).

Telia on Portulaceae

205. **Uromyces Spragueae** Hark. I, III
Bull. Calif. Acad. Sci., vol. 1, p. 44, 1884.

On *Calyptridium umbellatum* Torr. Greene, Lake Tahoe, Yosemite Valley, Alpine County (Hansen), Plumas County (Meinicke), King's River Cañon (Holway).

Telia on Caryophyllaceae

206. **Uromyces Caryophyllina** (Schrank) Wint. 0, I, II, III
Sch. Baier. Fl., vol. 2, p. 666, 1789; Rab. Krypt. Flora, vol. 1, p. 149, 1881.

Uredinia and telia frequent throughout the state on certain varieties of *Dianthus caryophyllus* L., and sometimes the cause of large losses to florists. It was introduced into the eastern states about 1860 and first noted by the writer in California in 1896.

207. **Uromyces pulchellus** Ell. and Ev. II, III
Bull. Torr. Club, vol. 22, p. 57, 1895.

On *Silene Douglasii* Hook., Lake Tahoe.

Telia on Ranunculaceae

208. **Uromyces Aconiti-lycoctoni** (DC) Wint. I, II, III
Rabh. Krypt. Flora, vol. 1, p. 153, 1884.

On *Aconitum columbianum* Nutt., Sisson.

209. **Uromyces Jonesii** Peck. II, III
Bot. Gaz., vol. 7, p. 45, 1882.

On *Ranunculus flammula* L., King's River Cañon (Holway).

Telia on Leguminoseae

210. **Uromyces abbreviatus** Arthur. III
Bull. Torr. Club, vol. 42, p. 587, 1915.

On *Psoralea physoides* Dougl., Calistoga (Harkness), Pinehurst (Bethel).

211. **Uromyces albus** Diet. and Holw. I, III
Hedwigia, vol. 36, p. 297, 1897.

On *Vicia americana* Muhl., Crocker's Ranch, Mariposa County; on *V. americana truncata* Brewer, Sloate, Plumas County (Horne); on *V. californica* Greene, Cuyamaca Mountains (LeRoy Abrams), San Diego County (Bethel).

212. **Uromyces appendiculatus** (Pers.) Link. 0, I, II, III
Ann. Bot. Usteri, vol. 15, p. 16, 1795; Link, Observ., vol. 2, p. 26, 1816.

On *Phaseolus vulgaris* L. and *P. lunatus* L., frequent, especially in the southern part of the state, but not destructive.

213. **Uromyces Fabae** (Pers.) De Bary. 0, I, II, III
Neues Mag. Bot., vol. 1, p. 93, 1794; Ann. Sci. Nat., Bot., vol. 20, p. 80, 1863.

On *Lathyrus Bolanderi* Wats., *L. Jepsonii* Greene, *L. violaceus* Greene and *L. Torreyi* Gray, common in the bay region; on *L. sulfureus* Brewer, Plumas County (Horne).

214. **Uromyces fallens** (Desmaz) Kern
Plant Krypt., 1325; Kern, Phytopath., vol. 1, p. 6, 1911.

On *Trifolium pratense* L., of frequent occurrence in both the northern and southern portions of the state.

215. **Uromyces Glycyrrhizae** (Rabh.) Magn. II, III
Ber. deutsch. bot. Ges., vol. 8, p. 383, 1890.

On *Glycyrrhiza lepidota glutinosa* Wats., Tuolumne County, Walnut Grove, Cloverdale (Heller), Victorville (Bethel).

216. **Uromyces Lupini** B. and C. 0, I, II, III
Proc. Am. Acad. Arts and Sci., vol. 4, p. 127, 1858.

On *Lupinus formosus bridgesii* Green, *L. albifrons* Benth. and *L. Chamissonis* Esch., frequent in the bay region; on *L. rivularis* Dougl., San Bernardino County (Parish); on *L. Douglasii* Agardh, King's River Cañon (Holway); on *L. latifolius* Agardh., Santa Cruz County (Thompson).

217. **Uromyces Medicaginis** Pass. II, III
Thüm, Herb. Myc. Oecon., p. 155, 1874.

On *Medicago lupulina* L., Berkeley and Humboldt County; on *M. sativa* L., common, especially in the southern part of the state.

218. **Uromyces oblongus** Vize. I, III

Grevillea, vol. 5, p. 110, 1877.

On *Trifolium variegatum* Nutt., *T. gracilentum* T. and G., *T. microcephalum* Pursh., *T. microdon* H. and A., *T. dubium* Sibth., *T. roscidum* Greene, *T. ciliolatum* Benth., *T. depauperatum* Desv., *T. albopurpureum* T. and G., *T. Macraei* H. and A., *T. tridentatum* Lindl., *T. stenophyllum* Nutt., *T. oliganthum* Steud. Of frequent occurrence in the Coast Ranges and in the Sierras.

219. **Uromyces occidentalis** Diet. II, III

Hedwigia, vol. 42, p. 98, 1903.

On *Lupinus leptophyllus* Benth., Sisson; on *L. latifolius* Agardh, Boulder Creek and Berkeley.

220. **Uromyces punctatus** Schröt. 0, I, II, III

Abh. schles. Ges., vol. 48, p. 10, 1870.

Aecia on species of *Euphorbia* but not reported from America.

Uredinia and rarely telia on *Astragalus Menziesii* Gray, San Francisco; on *A. lentiginosus* Dougl., Kern County (Davy); on *A. leucopsis* Torr., Long Beach (Bethel); on *A. Preussii* Gray, Indio (E. A. Bessey); on *A. Purshii* Dougl., Hornbrock (Copeland); on *A. pycnostachys* Gray, San Mateo County (Baker); on *Lotus eriophorus* Greene, San Francisco (M. E. Jones); on *L. glaber* (Vogel) Greene, Long Beach (Bethel).

221. **Uromyces Trifolii** (Hedw.) Lev. I, II, III

An. Sci. Nat., sér. 3, Bot., vol. 8, p. 371, 1847.

On *Trifolium repens* L., frequent in both the northern and southern part of the state, but not destructive.

Telia on Euphorbiaceae

222. **Uromyces proeminens** (DC) Pass. 0, I, II, III

Fl. franc., vol. 2, p. 235, 1805; Rabh. Krypt. Flora Europ., p. 1795, 1873.

Aecia (*Aecidium Euphorbiae-hypericifoliae* Schw.) on *Euphorbia serpyllifolia* Pers., Berkeley, Olema, San Francisco, Amador County (Hansen), King's River Cañon (Holway), Catalina Island (McClatchie); on *E. polycarpa* Benth., Mojave County (Parish); on *E. albomarginata* T. and G., Inglewood (LeRoy Abrams).

Telia on Hypericaceae

223. **Uromyces Hyperici-frondosi** (Schw.) Arthur. 0, I, II, III
Schw. mat. Ges., Leipzig, vol. 1, p. 68, 1822; Arthur, Bull. Minnesota Acad. Sci., vol. 2, p. 15, 1883.

On *Hypericum anagaloides* Ch. and Sch., San Francisco, Olema, Mendocino County; on *H. Scouleri* Coulter, Amador County (Hansen).

Telia on Primulaceae

224. **Uromyces nevadensis** Hark. III
Bull. Calif. Acad. Sci., vol. 1, p. 36, 1884.

On *Primula suffrutescens* Gray, Lake Tahoe (Harkness). This collection was probably made in Nevada but very near the California boundary.

225. **Uromyces Armeriae** (Schl.) Lev. I, II, III
Ann. Sci. Nat., sér. 3, Bot., vol. 8, p. 375, 1847.

On *Armeria vulgaris* Willd., San Francisco, Pacific Grove (Heller).

Telia on Plumbaginacae

226. **Uromyces Limonii** (DC) Lév. I, II, III
Fl. franc., vol. 2, p. 195, 1805; Lev., Dict. d'hist. nat., p. 19, 1840.

On *Statice Limonium* L. var. *californicum* Gray, San Francisco, Belmont, Long Beach (Bethel).

Telia on Acanthaceae

227. **Uromyces Ruelliae** Holway. II, III
Ann. Mycol., vol. 2, p. 394, 1904.

On *Beloperone californica* Benth., western edge of the Colorado Desert, type of *Uredo Beloperonis* Arthur (Parish).

Telia on Compositae

228. **Uromyces Bidentis** Lagh. II, III
Bull. Soc. Mycol. France, p. 213, 1895.

On *Bidens pilosa* L., Orange; on *B. expansa* Greene, Long Beach (Bethel).

UROPYXIS Schrot
Hedwigia, vol. 14, p. 165, 1875.

Uredinia erumpent, usually with paraphyses; urediniospores borne singly on pedicels. Telia erumpent; teliospores two-celled by a transverse septum; inner wall firm and deeply colored, outer wall gelatinous, thick.

229. **Uropyxis Amorphae** (Curt.) Schroet. II, III

Am. Jour. Arts and Sci., (2), vol. 6, p. 353, 1848; Hedwigia, vol. 14, p. 165.

On *Amorpha californica* Nutt., Mount Tamalpais and Los Gatos, Catalina Island (Bethel).

230. **Uropyxis sanguinea** (Peck) Arthur. II, III

Bot. Gaz., vol. 4, p. 128, 1879; N. A. Flora, vol. 7, p. 155.

On *Berberis pinnata* Leg., Berkeley; on *B. nervosa* Pursh., Humboldt County; on *B. repens* Lindl., Calaveras and Tuolumne counties.

ADDENDA

The following represent important additions to the foregoing list the data for which were received too late for inclusion in the proper sequence.

231. **Cronartium occidentale** Hedgcock, Bethel, and Hunt. 0, I, II, III

Jour. Agric. Research, vol. 14, p. 411, 1918.

Aecial stage not as yet reported from California but found in Colorado, Utah, New Mexico, and Arizona on species of *Pinus* belonging to the piñon group.

Uredinia and telia on *Ribes tenuiflorum* Lindl., "abundant along river wash near Monrovia" (Bethel). It was first reported from the same locality by W. M. Phillipson.

This record is of especial interest on account of the similarity of the uredinial and telial stages to those of the white pine blister rust, the aecial stage of which is very destructive to pines of the five-leaved group.

232. **Gymnosporangium inconspicuum** Kern. 0, I, III

Bull. Torr. Club, vol. 34, p. 461, 1907.

Aecia (*Roestilia Harknessianoides* Kern) on *Amelauchier* sp.

Telia on *Juniperus occidentalis* Hook. Both forms collected by Bethel in Bear River Valley, San Bernardino Mountains.

233. **Melampsora monticola** Mains. II, III

Phytopathology, vol. 7, p. 103, 1917.

Uredinia on *Euphorbia* sp., San Jose Cañon, near Carmel (Holway); on *E. leptosera* Engelm., Pacific Grove (Mrs. Clemens).

234. **Puccinia Andropogonis** Schw. 0, I, II, III

Trans. Am. Phil. Soc., II, vol. 4, p. 295, 1834.

Aecia on *Penstemon Menziesii* Hook., Yosemite Valley and Lake Tahoe.

Telia not reported from California, but to be expected on species of *Andropogon.*

235. **Puccinia Toumeyi** Sidow. III

Saccardo, Sylloge Fung., vol. 16, p. 299, 1902.

On *Penstemon spectabilis* Thurber, Mount Lowe.

236. **Puccinia yosemitana** Blasdale, sp. nov. I, III

Aecia usually solitary and widely scattered, cylindrical, about 0.2 mm. wide and 2.0 mm. long, orange yellow; pseudoperidia of thick-walled cells with deeply-colored contents, finally dehiscing by disintegration at apex.

Telia associated with aecia, amphigenous, scattered but occasionally confluent, about 0.5 mm. long, elliptical, black, pulverulent, early naked; teliospores ellipsoid or oblong, rounded and but slightly thickened at apex, barely constricted at septum, smooth, 32–38 by 20–22μ; pedicel thick, persistent, often 80μ long.

On *Gilia pungens* var. *Hookeri* Gray, found on trail from Yosemite Valley to top of Yosemite Falls.

237. **Pucciniastrum Galii** Fischer

Ured. d. Schweitz, p. 471, 1904.

Uredinia on *Galium triflorum* Michx. Yosemite Valley.

3. **Aecedium Trigochinis** Diet. and Holway

It has been shown very recently by Bethel that this is one of the many forms representing the aecial stage of *Puccinia submitens.*

67. **Puccinia sejuncta** Sydow.

It is now known that the form referred to under this number is *Aecidium Columbiense* Ell. and Ev. (Erythea, vol. 1, p. 206, 1893).

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